

**IN THE UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA**

OAKLAND DIVISION

EPIC GAMES, INC.,)	
)	Case No. 4:20-CV-05640-YGR
)	
Plaintiff,)	
)	Date: September 28, 2020
v.)	
)	Courtroom: 5, 17th Floor
APPLE INC.,)	
)	Judge: Hon. Yvonne Gonzalez
)	Rogers
Defendant.)	
)	

Declaration of Dr. David S. Evans

September 4, 2020

Table of Contents

I.	Introduction	1
II.	Software Platforms and App Distribution for Smartphones	2
A.	<i>Background</i>	2
1.	Software Platforms	2
2.	Application Distribution and Stores	3
3.	Smartphone Software Platforms	6
4.	Smartphone App Distribution	9
B.	<i>Analysis of Market Definition and Market Power for Smartphone Software Platforms</i>	10
1.	Smartphone Software Platforms	10
2.	Apple’s Market Power in the Smartphone Software Platform Market	13
C.	<i>Analysis of Market Definition and Market Power for App Distribution</i>	23
1.	Market Definition for App Distribution	23
2.	Apple’s Market Power over App Distribution for the iOS Software Platform	24
III.	In-App Payment Processing is a Separate Product from the App Store	25
A.	<i>Payment Processing</i>	27
B.	<i>Separate Product Analysis</i>	28
C.	<i>Market Definition</i>	31

I. Introduction

1. My name is David S. Evans. I'm the Chairman of Global Economics Group, LLC, based in its Boston office, and the Co-Executive Director of the Jevons Institute for Competition Law and Economics at University College London where I am also a Visiting Professor. I have BA, MA, and Ph.D. degrees in economics from the University of Chicago. As an economist, I specialize in the field of industrial organization, which concerns the behavior of firms and their interactions. I have authored, sometimes with co-authors, six major books and more than 100 scholarly articles, which have been widely read and cited, including by the Supreme Court in its *Ohio v. American Express*¹ decision.² A substantial portion of my research, writing, and teaching concern platform-based businesses and the digital economy, including smartphones. My curriculum vitae is attached as Appendix A.

2. Over the last 30 years, I have taught classes on antitrust economics and related topics at the University of Chicago Law School, University College London Faculty of Laws, and Fordham University Law School. I have testified before federal courts, state courts, and administrative law courts in the US and before the European General Court and the Supreme People's Court of China. In addition, I have testified before several committees of the US Congress, including the Senate Banking Committee, the House Financial Services Committee, and the House Oversight Committee, and before the House of Lords in the United Kingdom.

3. Counsel for Epic Games, Inc. ("Epic") asked me to address two topics related to their motion for a preliminary injunction:

1. Is it likely that, based on further research and analysis, I will conclude that Apple has substantial market power in an antitrust market for the distribution of iOS-compatible apps?
2. Is it likely that, based on further research and analysis, I will conclude that there is material demand for using payment processing for in-app purchases separate from that provided by the app distributor?

¹ 138 S. Ct. 2274, 2280-81, 2285-89, 2300 (2018).

² As of July 2020, I ranked among the top two percent of published economists according to quality-weighted citations by IDEAS/RePEc which tracks publications and citations by economists worldwide. See Top 10% Authors, as of June 2019, <https://ideas.repec.org/top/top.person.all.html>.

4. This declaration explains my basis for answering both of these questions affirmatively based on my preliminary research and information from Epic and its counsel, as well as my general expert knowledge as an economist. I try to do so succinctly by focusing on the key considerations. The opinions expressed in this declaration are based on information available to me at this time. My work in this matter is ongoing and I reserve the right to revise or supplement my opinion if any additional information makes that appropriate, or to correct any inadvertent errors.

II. Software Platforms and App Distribution for Smartphones

A. Background

5. This section provides a brief overview of software platforms for computing devices generally, and the distribution of applications for them, and then focuses on smartphones.

1. Software Platforms

6. A “software platform” is an operating system for computing devices that enables developers to write applications for compatible computing devices that have that software platform installed. It thereby enables consumers to use those applications on those devices.³ Software platforms expose application programming interfaces (APIs) that enable developers to access built-in capabilities of the device as well as to obtain other software services provided by the platform.⁴ Typically, software platforms are not compatible with each other, such that applications written for one platform do not work on the other. A developer must have separate code for each platform and a consumer cannot use applications for one software platform on another.

³ For a general introduction to software platforms, see Evans, David, Andrei Hagiu, and Richard Schmalensee (2006) *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries*, MIT Press, at Chapters 1-2, and the references cited there. See also Gagne, Greg, Peter Galvin, and Abraham Silberschatz (2014) *Operating System Concepts Essentials*, 2nd Edition, Wiley, at p. 3 (“An operating system is a program that manages a computer’s hardware. It also provides a basis for application programs and acts as an intermediary between the computer user and the computer hardware.”). Some operating systems, unlike the ones discussed here, do not support third-party applications and therefore do not provide a software platform for developers and users.

⁴ David Orenstein, “Application Programming Interface,” Computerworld, January 10, 2000, <https://www.computerworld.com/article/2593623/application-programming-interface.html>.

7. Software platforms, such as Microsoft’s Windows, are two-sided businesses that facilitate connections between consumers who want to use applications and developers who want to write applications for those consumers.⁵ Economists use the term “positive indirect network effects” to refer to the situation in which the addition of one type of participant to a network increases the value received by the other type of participant on that network. Users value software platforms that have more developers writing applications they would like to use; developers value software platforms that provide them access to more potential customers.⁶ There are therefore positive indirect network effects for both users (who benefit from more developers) and developers (who benefit from more users). It is widely accepted that there are substantial positive indirect network effects for software platforms.

8. Software platform providers typically make money from users by, for example, licensing the software platform to original equipment manufacturer (OEMs) that manufacture the computing devices on which the software platform is loaded (such as Microsoft Windows) or selling their own devices with the software platform included (such as Apple macOS). Software platform businesses usually provide software development kits (SDKs) and other tools that help developers write applications that work with that platform, which they provide for free or charge nominal fees. That is a common two-sided pricing strategy for stimulating indirect network effects and driving platform growth. Encouraging app development results in more users, which in turn stimulates more app development, which leads to more users.

2. Application Distribution and Stores

9. Software developers can distribute their applications for a software platform to consumers that use that platform in several ways, as seen from the experience in personal

⁵ Rochet, Charles and Jean Tirole (2003) “Platform Competition in Two-sided Markets,” *Journal of the European Economic Association* 1(4), pp. 990-1029 at pp. 992, 1015-1016; Choudary, Sangeet, Geoffrey Parker, and Marshall Van Alstyne (2016) *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You*, W. W. Norton & Company, at p. 30 (Kindle Edition).

⁶ Rochet, Charles and Jean Tirole (2003) “Platform Competition in Two-sided Markets,” *Journal of the European Economic Association* 1(4), pp. 990-1029 at pp. 992, 1015-1016; Choudary, Sangeet, Geoffrey Parker, and Marshall Van Alstyne (2016) *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You*, W. W. Norton & Company, at p. 21 (Kindle Edition); Cusumano, Michael, Annabelle Gawer, and David Yoffie (2019) *The Business of Platforms: Strategy in the Age of Digital Competition, Innovation, and Power*, HarperCollins, at pp. 16-17, 94-95, 221 (Kindle Edition); Evans, David, Andrei Hagiu, and Richard Schmalensee (2006) *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries*, MIT Press, at pp. 55-56.

computers. (1) Developers can distribute the application directly. For example, a consumer can sign up for and download TurboTax, for either the Windows or macOS software platforms, from TurboTax's website.⁷ (2) Developers can enter into a deal with the maker of a computing device to pre-install the software on the device. For example, personal computers and smartphones often come with applications pre-installed. (3) Developers can distribute their applications through online stores or, in some cases, through brick-and-mortar stores⁸ that distribute applications. Valve, for example, operates an online store called Steam for distributing PC gaming applications.⁹ In all cases, application distribution occurs downstream from the software platform.

10. Application stores, like other stores, make applications available to consumers, allow them to search and browse applications, and provide relevant information to them, supply marketing and promotion support to developers, among other things. Stores that distribute applications, like stores in general, can provide a wide array of applications or specialize in a particular category. In addition, stores that distribute applications, such as Amazon, may be parts of larger stores that sell a variety of products. Application stores can make money by charging the developer a commission on sales or charging the consumer a markup on the wholesale price. They can also make money in other ways, such as by selling advertising or providing other promotional efforts on their stores. As is the case with distributors generally, application stores operate downstream from the software platform.

11. Software platforms and application distributors are not interchangeable for users or developers. Developers and users rely on the software platform for computer code that provides a standard application environment. Developers and users rely on application stores, or other methods, for application distribution. Over the years, for example, many application stores have operated separately from software platforms. These include PC gaming application stores such

⁷ TurboTax, "Which TurboTax CD/Download product is right for you?" <https://turbotax.intuit.com/personal-taxes/cd-download/>.

⁸ To simplify the exposition, the term "store" in this declaration refers to an entity that distributes products for multiple sellers unless otherwise noted. In practice, some sellers operate their own stores for their own products.

⁹ Steam, "About," <https://store.steampowered.com/about/>; PC Magazine, "Steam Review," August 14, 2020, <https://www.pcmag.com/reviews/steam-for-pc>.

as Steam¹⁰, Epic Games Store¹¹, GOG.com¹², and Facebook Gameroom,¹³ as well as stores such as Amazon¹⁴ and GameStop.¹⁵ There is therefore material demand, by users and developers, for application distributors that is separate from the demand for software platforms.

12. Some software platforms have decided to vertically integrate downstream into application stores. Apple, for example, has sold software applications for macOS in its online store since at least 2000, in its physical stores since 2001, and in the Mac App Store that is included with the macOS operating system starting in 2011, which was 27 years after launching the Mac.¹⁶ Microsoft has sold software applications for Windows in its online store since at least 2004 and in its Windows Store that is included with the Windows operating system starting in 2012, which was 27 years after launching Windows.¹⁷ In addition to vertically integrating into application stores, Apple and Microsoft both eventually included their stores as self-supplied applications for their respective personal computer software platforms. In both cases, users and developers can also rely on other application stores and direct distribution to

¹⁰ Steam, “About,” <https://store.steampowered.com/about/>.

¹¹ Epic Games, “Epic Games Store,” <https://www.epicgames.com/store/en-US/>.

¹² GOG.com, “About,” https://www.gog.com/about_gog.

¹³ Facebook, “Facebook Gameroom,” <https://www.facebook.com/gameroom/download/>.

¹⁴ Amazon, “Video Games,” https://www.amazon.com/gp/browse.html?node=468642&ref=nav_em_cvg_0_2_13_10.

¹⁵ GameStop, “Video Games,” <https://www.gamestop.com/video-games>.

¹⁶ Apple launched the Mac computer in January 1984. See Erik Sandberg-Diment, “Hardware Review: Apple Weighs In With Its Macintosh,” *The New York Times*, January 24, 1984, <https://www.nytimes.com/1984/01/24/science/personal-computers-hardware-review-apple-weighs-in-with-macintosh.html>. Archived screenshots of Apple’s online store in 2000 featured MacOS applications. See Internet Archive, “The Apple Store (U.S.),” as of October 27, 2000, <https://web.archive.org/web/20001027145012/http://www.store.apple.com/1-800-MY-APPLE/WebObjects/AppleStore>. The first Apple brick-and-mortar store opened in 2001, offering “over 300 third-party software titles for professionals and consumers, including some of the best educational titles for kids.” See Apple, “Apple to Open 25 Retail Stores in 2001,” May 15, 2001, <https://www.apple.com/newsroom/2001/05/15Apple-to-Open-25-Retail-Stores-in-2001/>. The Mac App Store launched in 2011. See PCMag Staff, “Apple’s Mac App Store: Hands On,” *PC Magazine*, January 6, 2011, <https://www.pcmag.com/archive/apples-mac-app-store-hands-on-258979>.

¹⁷ Microsoft, “Windows Marketplace Opens for Business; Consumers Can Easily Discover A World of Products That Work With Windows,” October 12, 2004, <https://news.microsoft.com/2004/10/12/windows-marketplace-opens-for-business-consumers-can-easily-discover-a-world-of-products-that-work-with-windows/>; PCMag Staff, “13 New Features In Windows 8 Consumer Preview,” *PC Magazine*, February 29, 2012, <https://www.pcmag.com/archive/13-new-features-in-windows-8-consumer-preview-294819>; Samuel Gibbs, “From Windows 1 to Windows 10: 29 years of Windows evolution,” *The Guardian*, October 2, 2014, <https://www.theguardian.com/technology/2014/oct/02/from-windows-1-to-windows-10-29-years-of-windows-evolution>.

obtain software from sources other than the software platform owner—the store supplied by the software platform owner is not the only option.

13. For smartphones, as for personal computers, software platform providers operate upstream and application distributors operate downstream. By listing the applications on their virtual shelves and providing information, the application stores facilitate the distribution of the applications to users. An application store provides distribution services as an input to the application developers.¹⁸

3. Smartphone Software Platforms¹⁹

14. Smartphones are relatively small, portable computing devices that consumers use in conjunction with a subscription to a mobile carrier.²⁰ They provide Internet access over the carrier’s mobile broadband network as well as over Wi-Fi. They also provide calling over the carrier’s voice network. The manufacturer of the smartphone installs a smartphone software platform.

15. Like other software platforms, those for smartphones enable developers to write applications, and for consumers to use those applications, for computing devices with that smartphone software platform installed. Applications for smartphones are usually referred to as “apps” and the stores for those apps as “app stores”.²¹ Many apps rely on the Internet to provide services to smartphone users. Although the app runs locally on the smartphone, it is connected over the Internet to software running on remote servers.

16. Nowadays, almost all smartphones have software platforms provided by Apple (iOS) or Google (Android).²² These two companies accounted for the software platforms installed on nearly all smartphones sold between 2016 to 2020.²³ Almost all smartphone apps are written

¹⁸ They rely on this input because that is where consumers may go to get apps.

¹⁹ Smartphone software platforms are also used, with some modifications, on tablets. In the interest of brevity, this declaration discusses smartphones and notes the role of tablets in footnotes when relevant.

²⁰ PC Magazine Encyclopedia, “smartphone,” <https://www.pcmag.com/encyclopedia/term/smartphone>.

²¹ PC Magazine Encyclopedia, “app,” <https://www.pcmag.com/encyclopedia/term/app>.

²² Apple bundles iOS with iPhones, which it designs and uses entities such as Foxconn to manufacture. Google licenses its version of Android to handset makers such as Samsung.

²³ Calculations based on IDC, “IDC Quarterly Mobile Phone Tracker”.

for one or both of these software platforms. Putting China aside, other software platforms for smartphones have largely exited the business and there has been no meaningful entry in recent years.²⁴

17. Apple and Google provide developers access to APIs that enable these developers to integrate with the software code and obtain services provided by their respective software platforms.²⁵ They also provide developers access to tools for writing and testing apps for their respective platforms. These tools include software applications that help developers manage and catalog versions of their code and design and test user interfaces without having to write the underlying code. They also offer code debugging assistance, advanced code completion, and suggested corrections for common coding mistakes.²⁶

18. As is the case with other software platforms, developers pay Apple and Google nothing or nominal fees for access to tools developers rely on to write compatible smartphone apps.

²⁴ Handset makers formed a joint venture to create the Symbian operating system for mobile devices. The last Symbian-based smartphone was released in 2012, and Nokia subsequently transitioned to the Windows mobile operating system. Nokia shut off Symbian developers' ability to make changes to existing apps or publish new ones on the Nokia Store in 2014. *See* Matt Warman, "Nokia ends Symbian era," The Telegraph, January 24, 2013, <https://www.telegraph.co.uk/technology/nokia/9824179/Nokia-ends-Symbian-era.html>; Liam Tung, "Nokia says final sayonara to Symbian and MeeGo apps as store freezes updates," ZDNet, January 2, 2014, <https://www.zdnet.com/article/nokia-says-final-sayonara-to-symbian-and-mee-go-apps-as-store-freezes-updates/>. Microsoft introduced a version of Windows that ran on mobile phones and supported apps. Microsoft ended service for its mobile operating system in January 2020. *See* Liam Tung, "Microsoft gives Windows 10 Mobile a little extra time before the end," ZDNet, December 17, 2019, <https://www.zdnet.com/article/microsoft-gives-windows-10-mobile-a-little-extra-time-before-the-end/>. BlackBerry used its own operating system for its business-oriented devices that provided secure e-mail. BlackBerry switched to using the Android operating system for its smartphones and announced that support for the BlackBerry operating system would end in 2019. BlackBerry subsequently announced it would continue limited support beyond 2019. *See* BlackBerry, "Supporting BB10 and BBOS Customers and Rewarding Your Loyalty," December 14, 2017, <https://blogs.blackberry.com/2017/12/supporting-bb10-and-bbos-customers-and-rewarding-your-loyalty>; BlackBerry, "Our Commitment to BB10 and Some Changes to BlackBerry Legacy Services," July 31, 2019, <https://blogs.blackberry.com/en/2019/08/our-commitment-to-bb10-and-some-changes-to-blackberry-legacy-services>. Samsung's Tizen operating system has not been formally discontinued for smartphones, but there hasn't been a new Tizen smartphone since May 2017, and Samsung has discontinued a key Tizen app. *See* Sumit Adhikari, "My Galaxy Discontinuation on Tizen Phones the Final Nail in the Coffin?" SAM Mobile, January 31, 2019, <https://www.sammobile.com/2019/01/31/samsung-discontinue-my-galaxy-tizen-series/>. (Samsung continues to use Tizen for smart TVs and other non-smartphone devices.) Amazon has discontinued its Fire smartphones but continues to produce and support Fire tablets. *See* NDTV Correspondent, "Amazon Fire Phone Discontinued," Gadgets360, September 10, 2015, <https://gadgets.ndtv.com/mobiles/news/amazon-fire-phone-discontinued-738395>.

²⁵ Apple Developer, "Technologies," <https://developer.apple.com/documentation/technologies>; Android Developers, "Android 10 features and APIs," <https://developer.android.com/about/versions/10/features>.

²⁶ Apple Developer, "Xcode IDE," <https://developer.apple.com/xcode/features/>; Android Developers, "Android Studio Features," <https://developer.android.com/studio/features>.

Apple makes access to its software development kits available for free. For access to its developer program, which provides additional rights, Apple charges an annual fee of \$99 (or \$299 for an enterprise account intended for the distribution of apps for internal use within an organization).²⁷

19. Apple's revenues from its iOS software platform come primarily from selling iPhones (and iPads), which run on iOS, to users. In 2019, Apple had \$146.4 billion in iPhone sales and \$20.5 billion in iPad sales, for a total of \$166.9 billion.²⁸ Apple's App Store revenues in 2019 were approximately \$16.6 billion.²⁹ Thus, approximately 91 percent ($166.9/(166.9+16.6)$) of Apple's iOS related revenues come from selling iPhones and iPads. Google makes money from Android primarily by bundling its ad-supported apps with Google Android phones, acquiring attention from users, and then giving advertisers access to that attention.³⁰

²⁷ Apple, "Enrollment – Support – Apple Developer," <https://developer.apple.com/support/enrollment/>.

²⁸ Apple, SEC Form 10-K for the Fiscal Year Ended September 28, 2019, at p.19; Apple, SEC Form 10-Q for the Fiscal Quarter Ended December 29, 2018, at p. 25; Apple, SEC Form 10-Q for the Fiscal Quarter Ended December 28, 2019. In addition to iPhone and iPad sales, Apple also receives revenues from sales of Apple Watches, AirPods, and other accessories that depend in part on ownership of iPhones and iPads.

²⁹ In January 2020, Apple reported it had paid out \$155 billion to developers since the launch of App the Store in 2008, with a quarter of that \$155 billion, or \$38.8 billion, having been paid in 2019. Assuming a 30/70 revenue split between Apple and the developers, this would imply revenues for Apple of $\$38.8 \text{ billion} \times (30/70) = \16.6 billion . Accounting for those developer payments that were made based on a 15/85 split, which are not reported separately, would result in a lower estimate of Apple's App Store revenues. See Apple, "Apple rings in new era of Services following landmark year," January 8, 2020, <https://www.apple.com/newsroom/2020/01/apple-rings-in-new-era-of-services-following-landmark-year/>. Assuming that the \$155 billion paid to developers consists of revenue paid to third-party developers, this estimate of Apple's App Store revenues would not include revenues for Apple's proprietary apps. Apple also receives revenues from the relatively modest fees it charges for access to its developer program.

³⁰ European Commission, "COMMISSION DECISION of 18.7.2018 relating to a proceeding under Article 102 of the Treaty on the Functioning of the European Union (the Treaty) and Article 54 of the EEA Agreement (AT.40099 – Google Android)," https://ec.europa.eu/competition/antitrust/cases/dec_docs/40099/40099_9993_3.pdf, at p. 111 ("Google's strategy is to ensure that Google Android is installed on as many smart mobile devices as possible as a way to ensure market penetration for its services and the collection of data used for the purposes of search advertising. As stated in an internal presentation to the Google Board of Directors [Google Executive], '[Google internal communications on business strategy]'", and fn 519 citing Liz Laffan, "[Report] A new way of measuring openness, from android to webkit the open governance index [updated]," ("Google has made Android available at 'less than zero' cost, since Google's core business is not software or search, but driving eyeballs to ads. As is now well understood, Google's strategy has been to subsidise Android such that it can deliver cheap handsets and low-cost wireless Internet access in order to drive more eyeballs to Google's ad inventory.").

4. Smartphone App Distribution

20. An “app store” specializes in distributing apps for smartphones.³¹ Amazon, for example, operates the Amazon Appstore for Android.³² A consumer can download the Amazon Appstore on his or her Android phone. The Amazon Appstore itself is similar to Amazon’s “book store”. The consumer can search, see product reviews, and make purchases. As with personal computers, the “app store” is distinct from the smartphone software platform. Other app stores generally operate similarly.

21. As with the macOS, Apple operates an applications store, the App Store, for iOS-compatible apps created by developers who have used iOS’s SDKs and software tools to create iOS-compatible apps.³³ Apple pre-installs the Apple iOS App Store, along with other apps provided by Apple, on each iPhone and the icon for the App Store appears on the home screen.³⁴

22. Unlike the macOS, Apple requires that developers make their apps available to iPhone owners exclusively through the Apple iOS App Store.³⁵ In addition, unlike applications for macOS, Apple does not allow software developers to distribute their apps directly to consumers and does not permit alternative app stores to run on iOS-based devices.³⁶

³¹ PC Magazine Encyclopedia, “app store,” <https://www.pcmag.com/encyclopedia/term/app-store>.

³² PC Magazine Encyclopedia, “Amazon Appstore,” <https://www.pcmag.com/encyclopedia/term/amazon-appstore>.

³³ Apple, “App Store Principles and Practices,” <https://www.apple.com/ios/app-store/principles-practices/>.

³⁴ For example, in iOS 12, the App Store was pre-installed on the home screen. *See* T-Mobile, “Pre-installed apps: Apple iPhone & iPad on iOS 12,” <https://www.t-mobile.com/support/devices/apple/apple-ios-12/pre-installed-apps-apple-iphone-and-ipad-on-ios-12>. The App Store has been pre-installed on iOS since the release of iPhone 3G in July 2008 with iOS 2.0. *See* Apple, “iPhone 3G On Sale Tomorrow,” July 10, 2008, <https://www.apple.com/newsroom/2008/07/10iPhone-3G-on-Sale-Tomorrow/>. Discussion in this declaration of Apple’s App Store or the iOS App Store refer to Apple’s iOS App Store unless otherwise noted. Apple also operates an Apple App Store for macOS.

³⁵ Complaint for Injunctive Relief, Exhibit A, *Epic Games, Inc. vs Apple Inc.*, Case No. 3:20-cv-05640-YGR, ECF No. 1 at 81 (August 12, 2020) (“Applications for iOS Products, Apple Watch, or Apple TV developed using the Apple Software may be distributed only if selected by Apple (in its sole discretion) for distribution via the App Store, Custom App Distribution, for beta distribution through TestFlight, or through Ad Hoc distribution as contemplated in this Agreement.”).

³⁶ Apple, “App Store Review Guidelines,” at 3.2.2(i), <https://developer.apple.com/app-store/review/guidelines/#unacceptable> (deeming as “unacceptable” the creation of “an interface for displaying third-party apps, extensions, or plug-ins similar to the App Store or as a general-interest collection.”). In addition to native mobile apps, developers can also provide web apps, which are mobile-optimized web pages that are intended to look like an app and which can be distributed outside of the iOS App Store by clicking on a link in a

23. As a result, Apple's App Store accounts for all downstream distribution of apps for the iOS software platform.

B. Analysis of Market Definition and Market Power for Smartphone Software Platforms³⁷

24. To analyze the possibilities for market power in the downstream distribution of apps, we need to start with the market constraints on smartphone software platforms that serve users and developers.

1. Smartphone Software Platforms

25. Users and developers do not have good substitutes for smartphone software platforms.³⁸

26. From the standpoint of the user, many apps are not available on personal computers or other devices in part because these apps rely on unique aspects of smartphones as mobile, always-connected computers. For some apps, the developer offers similar applications for personal computers, gaming consoles, or other platforms. Many consumers around the world rely on smartphones as their primary computing device. Many of these consumers do not own

web page. More advanced versions of web apps are called progressive web apps. Web apps have a number of limitations compared to native apps, especially on iOS (which places more limitations on what web apps can do than does Android). On iOS, web apps can only store up to 50 Mb offline, and iOS will delete the apps' files after a few weeks of disuse. Web apps have no ability to use Bluetooth, Beacons, Touch ID, Face ID, ARKit, altimeter sensor, battery information, background execution, contacts, background location, native social apps, push notifications, icon badge integration, or Siri integration. See Maxilmiliano Firtman, "Progressive Web Apps on iOS are here," Medium, March 30, 2018, <https://medium.com/@firt/progressive-web-apps-on-ios-are-here-d00430dee3a7>; Flavio Copes, "The Complete Guide to Progressive Web Apps," January 25, 2018, <https://flaviocopes.com/progressive-web-apps/>. As a result of these limitations, even major supporters of web apps such as the Financial Times have switched to using native apps. Financial Times, "FT iOS app returns to the Apple App Store," August 17, 2017, <https://aboutus.ft.com/en-gb/announcements/ft-ios-app-returns-to-the-apple-app-store/>.

³⁷ Software platform developers often make apps available in many countries and users get apps from developers who operate in different geographies. App stores and payment processors generally operate across many countries as well. It is likely, based on further development of information and analysis, that I will find that it is appropriate to consider that the relevant geographic markets discussed below for software platforms, iOS app distribution, and payment processing services for in-app purchases of digital content for iOS apps are essentially global. The smartphone business in China is very different than the rest of the world, however, and it is possible that I will conclude that it is not appropriate to include China in one or more of the relevant geographic markets. I have not had the opportunity to develop sufficient information or analyze the relevant details concerning China for the purposes of this declaration.

³⁸ The following discussion describes the situation in the pre-pandemic world and what I would expect to be the post-pandemic world. People are less mobile during the pandemic and are relying more on any non-mobile devices they have at home.

one of these other devices and some can't afford to do so. In addition, the consumers who do have these alternative devices may not have access, or convenient access, to these devices, for parts of their days when they want to use applications.³⁹

27. From the standpoint of the developer, the smartphone software platform is likely the only way they can reach smartphone users during times when consumers might want to use the app and don't have good substitutes. Even when consumers can use an app on another computing device, they would place less value on an app that was not available for their smartphone.⁴⁰ For example, in response to increased use of mobile devices to access their

³⁹ GSMA and AT Kearney (2013) "The Mobile Economy 2013," <https://www.gsma.com/newsroom/wp-content/uploads/2013/12/GSMA-Mobile-Economy-2013.pdf>, at pp. 7, 48 ("Smartphones are increasingly taking their place at the centre of people's lives. They enable us to access content at any time from almost anywhere - something many now take for granted. . . . Increasingly consumers are using their mobile as their primary device with which to access the Internet, in particular for communication and entertainment services due to the 'always on' nature of mobile phones."); IDC (2013), "Always Connected: How Smartphones and Social Keep Us Engaged," *IDC Research Report, Sponsored by Facebook*, <https://www.nu.nl/files/IDC-Facebook%20Always%20Connected%20%281%29.pdf>, at pp. 3, 5, 9-10 ("Social has become so engrained in our behavior that we engage with it even when doing every day activities. Using Facebook throughout the day is a given for most smartphone owners. The multitude of ways we use social, and specifically Facebook, (one-on-one, one-to-many, private, public, synchronous, asynchronous, etc.) allow it to fit easily and seamlessly throughout our days."); Think With Google, "Digital Video Upfronts: Putting YouTube On The Modern-Day Media Plan," October 2015, <https://www.thinkwithgoogle.com/intl/en-gb/consumer-insights/digital-video-upfronts-putting-youtube> ("Thanks to increasing smartphone penetration and the roll-out of 4G, digital video consumption is escalating through the roof – since March 2014 the number of daily YouTube watchers has grown 40% year over year. These people are seeking entertainment, information and inspiration while out and about, seated at their desks or relaxing at home."); Giancarlo Saldana, "Why mobile games are so popular," GamesRadar+, January 7, 2014, <https://www.gamesradar.com/why-mobile-games-are-so-popular/> ("Perhaps one of the easiest reasons mobile games are so popular is because they're easily accessible. . . . To add to all the happy people, mobile games are portable right out of their nonexistent box and can be enjoyed pretty much anywhere. Whether you're waiting for a bus or want to make that trip to the toilet a little more fun (trust me, people play on the can), games like Angry Birds or Hero Academy are there to the rescue."); Business Matters, "How did mobile gaming get so popular?" March 5, 2019, <https://www.bmmagazine.co.uk/business/how-did-mobile-gaming-get-so-popular/> ("[T]he main reason why mobile gaming has become so popular is that they can be easily accessed by everyone and at any time. . . . Equally, Mobile gaming can be played from anywhere and anytime. As you well know, a smartphone is portable and you can easily carry it from one place to another. You can play games on your mobile while in the kitchen, bathroom, outside watching birds or just doing what you love. You can be on a bus traveling and busy playing your favorite game. Because of this, mobile gaming has taken over and in the near future, it is going to beat all the online gaming platforms because of their portability."). Consumers view laptops and tablets as inferior to smartphones when on the go. Toney Bradley, "5 Ways Smartphones Are Better than Laptops or Tablets," PC World, January 6, 2012, https://www.pcworld.com/article/247388/5_ways_smartphones_are_better_than_laptops_or_tablets.html; Tag Mobile, "7 Reasons Smartphones Are Better than Laptops," June 3, 2016, <https://www.tagmobile.com/blog/7-reasons-why-smartphones-are-better-than-laptops/>.

⁴⁰ For instance, Snapchat has explained that its users substantially rely on on-the-go cellular connectivity. See Snapchat SEC Form S-1 Registration Statement (Third Amendment), filed February 24, 2017 at p. 15. Instagram initially launched as a smartphone app and did not offer a website that could be accessed on web browsers until a limited website was offered two years later. See Alexia Tsotsis, "Mobile First, Web Second: Instagram Finally

products, popular social media companies Facebook and Twitter altered their development priorities towards mobile devices and shifted to describing themselves as “mobile first” companies.⁴¹ The companies launched new mobile-oriented features for users such as live video streaming.⁴²

28. Not surprisingly, given these advantages, the amount of time the average adult smartphone user in the US spent using apps or the web on smartphones increased six-fold from 2011 to 2019, while the amount of time using personal computers online has remained roughly constant.⁴³ Apps that were widely used on personal computers are now mainly used on smartphones. For example, consumers use Facebook, Google, and YouTube primarily on mobile devices.⁴⁴

Lets Users Have Functional Web Profiles”, Tech Crunch, November 5, 2012, <https://techcrunch.com/2012/11/05/mobile-first-web-second-instagram-finally-lets-users-have-functional-web-profiles/>. In the past, Facebook reported the number of monthly active users who access Facebook through mobile devices. The most recent reporting was in 2016 Q4 when 94 percent of Facebook’s monthly active users accessed Facebook through mobile devices (up from 51 percent in 2011 Q4) and 62 percent *solely* accessed Facebook through mobile devices (up from 7 percent in 2011 Q4). *See* Facebook, “Facebook Q4 2016 Results,” https://s21.q4cdn.com/399680738/files/doc_presentations/FB-Q4'16-Earnings-Slides.pdf, at pp. 5-7; Facebook, “Facebook Q4 2012 Results,” at pp. 3, 5-6, <https://www.slideshare.net/kitseeborg/fb-q412-investordeck>.

⁴¹ Brian Chen, “Facebook Reorients Itself for a Small-Screen World,” The New York Times, August 23, 2012, <https://www.nytimes.com/2012/08/24/technology/facebook-rewrites-its-code-for-a-small-screen-world.html>; Alistair Barr, “Facebook’s Zuckerberg says mobile first priority,” Reuters, May 11, 2012, <https://www.reuters.com/article/net-us-facebook-roadshow/facebook-zuckerberg-says-mobile-first-priority-idUSBRE84A18520120512>; Tim Bradshaw, “Twitter is now a mobile-first company, says CEO,” Financial Times, June 29, 2012, <https://www.ft.com/content/c2bdd947-9c82-3f12-b782-48a39b7fc2e9>.

⁴² Ian Sherr, “Facebook jumps into the live video streaming craze,” CNET, August 5, 2015, <https://www.cnet.com/news/facebook-jumps-into-the-live-video-streaming-craze/>; Vadim Lavrusik, “Expanding Live Video to More People,” Facebook Newsroom, January 28, 2016, <https://newsroom.fb.com/news/2016/01/expanding-live-video>; Sara Haider, “Go Live on Twitter,” Twitter, December 14, 2016, https://blog.twitter.com/official/en_us/a/2016/go-live-on-twitter.html.

⁴³ Based on comparisons of the average time spent per adult user of each medium during the fourth quarter of the respective years. Nielsen began tracking smartphone time usage during 2011 Q4. *See* Nielsen, “The Cross-Platform Report March 2014,” at p. 9 (Exhibit 1); Nielsen, “The Nielsen Total Audience Report April 2020” at p. 10. Exhibit 1 of the 2014 Nielsen report is based on users of each medium. *See* Nielsen, “The Cross-Platform Report March 2014,” at p. 23. Data on smartphone usage by children are not as readily available, but it is likely that smartphone usage by children has grown similarly, if not more so, over the past decade.

⁴⁴ In 2015, Google announced that its mobile search volume overtook desktop volume in 10 countries including the US and Japan. *See* Google Inside AdWords, “Building for the next moment,” May 5, 2015, <https://adwords.googleblog.com/2015/05/building-for-next-moment.html>. In 2017, media measurement and analytics company Comscore estimated that 70 percent of the time spent on YouTube in the US. was accounted for by mobile devices. *See* Comscore, “Unlocking Mobile Measurement for YouTube in the U.S.,” February 23, 2017, <https://www.comscore.com/Insights/Infographics/Unlocking-Mobile-Measurement-for-YouTube-in-the-US>. Facebook doesn’t disclose the breakdown of time spent by consumers on their mobile versus their desktop app.

29. Given these considerations it is likely that further economic analysis, based on additional quantitative and qualitative evidence, would support the conclusion that a hypothetical monopolist of smartphone software platforms would not face significant competitive constraints. As a result, generally accepted methods for assessing the boundaries of the relevant antitrust market would likely conclude that smartphone software platforms is a relevant market.

30. As a practical matter outside of China, that market consists of Apple's iOS software platform and Google's Android software platform.⁴⁵ It is a duopoly market.

2. Apple's Market Power in the Smartphone Software Platform Market

31. There is a strong presumption, based on the economics of industrial organization, that each duopolist in the smartphone software platform market—Apple and Google—has substantial market power. Each provider would tend to tacitly coordinate its market decisions with the other provider, which would temper competition between them. The Horizontal Merger Guidelines incorporate these economic principles.⁴⁶ The antitrust authorities typically do not permit a 3 to 2 merger because the merger would likely significantly increase the market power of the merging firms and result in a duopoly market that would have a concentration score of at least 5,000 as measured by the Herfindahl-Hirschman Index (HHI), a standard index for measuring market concentration. The Horizontal Merger Guidelines characterize any market with an HHI score above 2,500 as highly concentrated.⁴⁷

However, Facebook's advertising revenue, which is broken out by desktop and mobile, provides a reasonable proxy because advertising sales are roughly proportional to viewing. As of 2019 Q3, Facebook reported that 94 percent of its advertising revenue came from mobile. *See* Facebook, "Facebook Reports Third Quarter 2019 Results," <https://investor.fb.com/investor-news/press-release-details/2019/Facebook-Reports-Third-Quarter-2019-Results/default.aspx>.

⁴⁵ It is possible that, based on an analysis of switching costs and other considerations, that iOS and Google's Android each could be considered separate relevant markets for the purposes of addressing the claims in this matter. For present purposes, the potential further narrowing of the software platform market would not affect my conclusions with respect to the iOS downstream markets discussed below.

⁴⁶ Horizontal Merger Guidelines, US Department of Justice and Federal Trade Commission, Section 7, August 19, 2010, <https://www.justice.gov/atr/horizontal-merger-guidelines-08192010>.

⁴⁷ Under the DOJ and FTC's Horizontal Merger Guidelines, a merger will be presumed to be anticompetitive if the post-merger concentration is above 2,500 and the increase in HHI is more than 200. In 3-2 mergers, the post-merger concentration is at least 5,000 because the HHI measure is smallest when all firms in a market are the same

32. To assess whether Apple has substantial market power in the smartphone software platform market, I have considered four sources of economic evidence.

a. Market Share Indicators

33. The market power of a software platform provider over users and developers depends on the extent to which users engage with apps, as opposed to using other phone features, and the extent to which these users are a source of direct or indirect revenue to the developer. Smartphone users vary in the extent to which they use the smartphone's software platform for using apps. Some people use smartphones primarily for making phone calls or sending text messages, while others use them as their main device for using apps online.

34. Apple has chosen to specialize in high-end smartphones compared to the average Android smartphone seller.⁴⁸ While there are high-end Android phones, the average iPhone has more capabilities relevant for consuming apps than the average Android phone and therefore likely appeals to people who tend to use apps more. Some Android smartphone makers have specialized in inexpensive handsets that have high penetration in lower-income countries with more limited Internet connectivity.

35. These considerations are reflected in the data on smartphone shares. From 2016 Q1 to 2020 Q1, Apple had a 40 percent revenue share of all smartphones sold worldwide excluding

size and the HHI for a duopoly with each firm having a 50 percent share is 5,000. The increase in HHI will be more than 200 unless the firms are small enough that the geometric average of the merging firms' pre-merger shares is 10 percent or less, which is true if the product of the merging firms' shares is 100 or lower (for example, the merging firms have market shares of 10 percent or less each, or they have shares that are less than 20 percent and 5 percent respectively). Thus, all 3-2 mergers involving merging firms of appreciable size "will be presumed to be likely to enhance market power" under the merger guidelines. *See* US Department of Justice and Federal Trade Commission, "Horizontal Merger Guidelines," Section 5.3, August 19, 2010, https://www.ftc.gov/system/files/documents/public_statements/804291/100819hmg.pdf; *see also* Lee Van Voorhis and Roxane Busey, "U.S. Trends in Antitrust Enforcement of Cartels and Mergers in a Global Environment," Baker McKenzie, January 25, 2016, <https://globalcompliancenews.com/u-s-trends-in-antitrust-enforcement-of-cartels-and-mergers-in-a-global-environment/> ("Generally, there have been consistent challenges by antitrust enforcement agencies to mergers where the number of competitors was reduced from 4 to 3, 3 to 2, or 2 to 1 or by competitors with large market shares").

⁴⁸ Vlad Savov, "The entire history of iPhone vs. Android summed up in two charts," The Verge, June 1, 2016, <https://www.theverge.com/2016/6/1/11836816/iphone-vs-android-history-charts>; Daniel Dilger, "IDC data shows 66% of Android's 81% smartphone share are junk phones selling for \$215," Apple Insider, November 12, 2013, <https://appleinsider.com/articles/13/11/12/idc-data-shows-66-of-androids-81-smartphone-share-are-junk-phones-selling-for-215>.

China, while its unit share was 17 percent.⁴⁹ These differences between revenue and unit shares result because almost all of Apple's iPhones sell for \$300 or more, with iPhones having an average selling price of \$790 during this period.⁵⁰ Among smartphones that sold for \$300 or more, Apple had a 57 percent revenue share and a 49 percent unit share.⁵¹

36. Users with high-end smartphones are of much greater importance to app developers.⁵² Consumers who are interested in using their smartphones extensively are likely to buy higher priced devices that are more advanced technologically, with faster processors, more memory and larger screens.⁵³ Consumers who buy higher-priced smartphones are more likely to have

⁴⁹ Apple had a 36 percent revenue share and 14 percent unit share globally, including China. I have access to tablet sales data globally and for the US during the same period. Apple had a 37 percent revenue share and 16 percent unit share of smartphone and tablet sales globally, including China. Calculations based on IDC, "IDC Quarterly Mobile Phone Tracker"; IDC, "IDC Quarterly Personal Computing Device Tracker".

⁵⁰ Figures reported are on a global basis, excluding China. From 2016 to 2020, 98 percent of Apple's iPhone units sold globally, excluding China, had average sales prices of \$300 or more. Including China, 98 percent of Apple's iPhone units sold globally had average sales prices of \$300 or more. Including China, 99 percent of Apple's iPad units sold globally had average sales prices of \$300 or more. Calculations based on IDC, "IDC Quarterly Mobile Phone Tracker"; IDC, "IDC Quarterly Personal Computing Device Tracker".

⁵¹ Figures reported are on a global basis, excluding China. Among smartphones that sold for \$300 or more, Apple had a 71 percent revenue share and a 69 percent unit share in the US, had a 54 percent revenue share and a 46 percent unit share in Western Europe, and had a 51 percent revenue share and a 41 percent unit share globally, including China. Among smartphones and tablets that sold for \$300 or more, Apple had a 71 percent revenue share and a 71 percent unit share in the US and had a 53 percent revenue share and a 44 percent unit share globally, including China. Among all smartphones, Apple had a 63 percent revenue share and a 41 percent unit share in the US and had a 46 percent revenue share and a 27 percent unit share in Western Europe. Among all smartphones and tablets, Apple had a 63 percent revenue share and a 40 percent unit share in the US. Calculations based on IDC, "IDC Quarterly Mobile Phone Tracker"; IDC, "IDC Quarterly Personal Computing Device Tracker".

⁵² Snapchat SEC Form S-1 Registration Statement (Third Amendment), filed February 24, 2017 at pp. 2, 64, 69, ("Our products often require intensive processing and generate high bandwidth consumption by our users. As a result, our users tend to come from developed countries with high-end mobile devices and high-speed cellular internet. . . . We often create new technologies and high engagement products that often require high-end mobile devices and high-speed cellular internet, and consequently the majority of our users come from developed markets. . . . We expect growth to continue to come from developed markets with readily available high-speed cellular internet and high-end mobile devices because we prioritize our investment in product innovation that often requires a lot of bandwidth and intensive processing.").

⁵³ Snapchat SEC Form S-1 Registration Statement (Third Amendment), filed February 24, 2017 at p. 120 ("Our focus on innovative camera experiences means that many of our products are data intensive and work better on high-end mobile devices. This is because camera products involve rich formats like video, which use a lot of cellular bandwidth when used for communication and content consumption. Additionally, our products often use technologies that demand a lot of processing power and don't work as well on lower-end devices, like the technology behind Lenses. This means that unlike many other free mobile applications, the majority of our users tend to be located in markets with high-end mobile devices and high-speed cellular internet."); Sarah Perez, "iOS App Launches Nearly Double That Of Android; Apps Used For Twice As Long," Techcrunch, November 18, 2014, <https://techcrunch.com/2014/11/18/ios-app-launches-nearly-double-that-of-android-apps-used-for-twice-as-long/> ("While both iOS and Android are now used by mainstream consumers, Android offers a range of devices that extend from high-quality hardware into low-end phones that are sometimes barely an upgrade from feature

more income to spend on app content.⁵⁴ By several metrics discussed next, Apple's share of app usage—and therefore software platform activity—is similar to its share of higher-end smartphones and its revenue share of all smartphones, and dissimilar to its unit share of all smartphones.

37. iPhone users are valuable to app developers to the extent developers can make money directly or indirectly from them. As one indication of their value, iPhone users tend to spend more on apps and on purchases within apps than Android users. iPhone users, globally, spent 90 percent more in the iOS App Store than Android users spent in the Google Play Store in 2020 H1.⁵⁵ That is, in terms of spending by consumers for paid apps and for in-app purchases of digital content, Apple had almost twice the revenue of Google. Other studies have also confirmed that iPhone users typically spend more than Android users on purchases of physical as well as digital goods.⁵⁶ It is likely that the same is true for the use of apps to purchase physical goods, and for advertising revenues earned from apps, for the same reasons.

38. The iOS software platform has been an important source of new players for Fortnite. Of the new players who created an account on mobile between April 21, 2020 (when Fortnite became available on the Google Play Store) and August 12, 2020 (the last full day before Fortnite was removed from the iOS App Store) more than 61 percent created their account on

phones. These low-end devices may be in the hands of those who aren't as interested in the app ecosystem, and merely needed the cheapest phone upgrade available from their carrier. These users also, understandably, would be careful about spending unnecessarily on paid apps, in-app purchases, and even on data usage itself.”).

⁵⁴ Mark Gurman, “Google’s Next Android Overhaul Will Embrace iPhone’s ‘Notch’,” Bloomberg, February 12, 2018, <https://www.bloomberg.com/news/articles/2018-02-12/google-s-next-android-overhaul-is-said-to-embrace-iphone-notch> (“While Android dominates the middle and low-end of the global smartphone market, Apple controls much of the high-end with users who spend more on apps and other services.”). This is consistent with Epic’s experience as the average iOS Fortnite user spends significantly more on in-app purchases than the average Android Fortnite user. See Complaint for Injunctive Relief, *Epic Games, Inc. vs Apple Inc.*, Case No. 3:20-cv-05640-YGR, ECF No. 1 at ¶ 46 (August 12, 2020).

⁵⁵ SensorTower, “Global App Revenue Reached \$50 Billion in the First Half of 2020, Up 23% Year-Over-Year,” June 30, 2020, <https://sensortower.com/blog/app-revenue-and-downloads-1h-2020>. Other sources report similar shares. For example, App Annie reports that global app store spending in 2020 Q1 was 81 percent higher in the iOS App Store than in Google Play. App Annie, “Weekly Time Spent in Apps Grows 20% Year Over Year as People Hunker Down at Home,” April 2, 2020, <https://www.appannie.com/en/insights/market-data/weekly-time-spent-in-apps-grows-20-year-over-year-as-people-hunker-down-at-home/>.

⁵⁶ Martin Meany, “Do iPhone Users Spend More Online Than Android Users?”, Moz, October 11, 2017, <https://moz.com/blog/apple-vs-android-aov>; Apps Flyer, “Lifetime Value: The Cornerstone of App Marketing (2018 LTV Benchmarks),” https://cdn2.hubspot.net/hubfs/597489/LTV%20Facebook%20Study%2006.2018/Lifetime_Value_The_Cornerstone_of_App_Marketing.pdf.

iOS.⁵⁷ So iOS accounted for about 61 percent of new Fortnite users who created an account on mobile over a period that is skewed toward more sign ups on Android because Fortnite had only recently become available on the Google Play Store while it had been available on the Apple App Store for more than two years.

39. These indicia are consistent with Apple having substantial market power in the smartphone software platform market. It has a large share of users that are valuable to developers and the only way for developers to access these users is through the iOS software platform. That drives developers to write apps for the iOS software platform, which increases the value to users of the iOS software platform.

b. Substitution Possibilities for Users and Developers

40. iPhone users often lack good substitutes for using iOS apps. In some cases, the developer may have created an application providing similar services for a software platform running on another computing device, such as a personal computer. Some iPhone users may not own that other device. And if they did own it, they may not have that device available when they have the time for and interest in using the iOS app.⁵⁸ In many cases, the developer has not written a similar application for another computing device, so iPhone users have no alternative.

41. Meanwhile, developers do not have meaningful substitutes for making their apps available to iPhone users other than using the iOS platform.⁵⁹ Developers would lose access to the active installed base of around 1 billion iPhones.⁶⁰ Developers that provide versions of their

⁵⁷ Based on data provided by Epic. I restrict the time period to start after Fortnite became available to Android users on the Google Play Store (in addition to via sideloading and Samsung's Galaxy Store) to avoid overstating the importance of iOS to Fortnite among smartphone platforms. Fortnite had already been available to iOS users for over two years, so the 61 percent iOS share of users who first made their account on mobile is lower during this period than it was prior to Fortnite's launch on the Google Play Store.

⁵⁸ See fn 39.

⁵⁹ As discussed in fn 36, developers can also provide web apps, but these web apps have a number of limitations compared to native apps, especially on iOS.

⁶⁰ Apple reported its iPhone active installed base as being over 900 million in January 2019 and as having increased by almost 75 million over the prior twelve months. S&P Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ1 2019 Earnings Call Transcripts," January 29, 2019, at p. 7. Continued growth since January 2019 at a similar rate would put the active installed base of iPhones at over 1 billion. Apple has stated that its iPhone active installed base has continued to grow since January 2019 but has not reported a specific growth rate or level. See S&P Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ2 2019 Earnings Call Transcripts," April 30, 2019, at p. 7; S&P Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ3 2019 Earnings Call Transcripts," July 30, 2019, at p. 7; S&P

apps on other devices, such as gaming consoles, would lose the opportunities for interacting with users who don't have those devices or who don't have them during situations in which they have the time for and interest in using the app.

42. Apple's CFO, Luca Maestri, has emphasized the importance of the company's installed base on the success of the App Store and Apple's Services⁶¹ segment:

And it's important to understand what is driving the growth of the [Services] business. First of all, it's our installed base. As we just told you, the installed base continues to grow very nicely. It has reached 1.4 billion active devices [of which more than 900 million were iPhones] at the end of December, and really, very little of our Services revenue is driven by what we sell in the last 90 days.⁶²

Therefore, the evidence is consistent with Apple having substantial market power over users and developers for the installed base of iPhone owners. Developers require access to this installed base, and users require access to the stock of apps.

c. Costs of Switching to Android for Installed Base of iOS Users

43. Even though iOS users and developers have to use the iOS software platform to interact with each other, it might be claimed that substantial numbers of iOS users would switch to Android in response to an attempt by Apple to exercise market power over users and developers. If they would, then this would reduce Apple's market power over developers, and therefore the software platform overall. It is unlikely, however, that the ability to switch to Android, the only other alternative, would prevent Apple from having substantial market power in the smartphone software platform market.

Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ4 2019 Earnings Call Transcripts," October 30, 2019, at p. 7; S&P Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ1 2020 Earnings Call Transcripts," January 28, 2020, at p. 7; S&P Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ2 2020 Earnings Call Transcripts," April 30, 2020, at p. 7; S&P Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ3 2020 Earnings Call Transcripts," July 30, 2020, at p. 5.

⁶¹ Apple's Services segment includes the Company's digital content stores and streaming services, AppleCare, Advertising, and other services. See Apple Inc. SEC Form 10-Q for the quarterly period ended June 27, 2020, at p. 8.

⁶² S&P Capital IQ, "Apple Inc. NasdaqGS:AAPL FQ1 2019 Earnings Call Transcript," January 29, 2019 at p. 10.

44. Consumers have invested in purchasing a smartphone that they generally keep for over two years.⁶³ Apple's annual iPhone sales in 2019 were about one fifth of its total installed base of iPhone active users.⁶⁴ At any given time, the substantial majority of Apple's installed base of active iPhone users are not in the market for a new device.⁶⁵

45. A consumer who did decide to replace her current iPhone would incur costs of switching to an Android device. Once a consumer has made her first purchase of an iPhone, and increasingly relies on iOS apps, she faces material costs of switching to an Android smartphone. As one smartphone purchasing guide for consumers noted:

When buying a phone, we generally recommend sticking with the same platform your current phone uses. At a minimum, switching entails learning the quirks of a new interface and potentially losing access to purchased apps, app-specific data, or even photo and data services... We generally recommend against [switching smartphone operating systems]. By the time you've used a phone for a couple of years, you've spent a lot of time learning its quirks, and you've probably invested a decent amount of money into apps, games, music, or videos that you may have to rebuy if you switch.⁶⁶

46. I identify eight sources of switching costs that, while they do not preclude people from changing smartphone software platforms, make it less likely they will do so in the face of an exercise of market power which causes a substantial increase in the cost, or decrease in the quality, of using the iOS software platform overall.

1. Users switching to Android have to learn how to use a new mobile operating system. Users who have used iPhones for many years have become accustomed to the interface and the functionality on iPhones, which differs from that on Android smartphones.

⁶³ Abigail Ng, "Smartphone users are waiting longer before upgrading — here's why," CNBC, May 16, 2019, <https://www.cnbc.com/2019/05/17/smartphone-users-are-waiting-longer-before-upgrading-heres-why.html>.

⁶⁴ IDC estimated that Apple sold 191 million iPhones in 2019. Calculations based on IDC, "IDC Quarterly Mobile Phone Tracker". Apple reported its iPhone active installed base as being over 900 million in January 2019 and as having increased by almost 75 million over the prior twelve months. Apple has stated that its iPhone active installed base has continued to grow since January 2019 but has not reported a specific growth rate or level. *See* fn 60.

⁶⁵ It is unlikely that the cost of in-app purchases would be a material factor in deciding between iOS and Android based smartphones because the expected lifetime cost of these purchases, which could include some pass-on of commission costs, would likely be a small share of the overall cost and benefits of the smartphone and its associated software platform and apps.

⁶⁶ Andrew Cunningham, "iPhone vs. Android: Which Is Better for You?" The New York Times, October 31, 2019, <https://www.nytimes.com/wirecutter/reviews/ios-vs-android/>.

2. Users have paid to download apps in Apple's App Store and would not be able to use those apps on an Android smartphone. Users switching to Android would lose access to their iOS apps and may lose access to data on those apps. Those apps might not be available on Android and, if they were, would likely need to be installed, and purchased where applicable, a second time.⁶⁷
3. Setting up a new iPhone, including migrating data, is much easier for an existing iPhone user than setting up an Android smartphone.⁶⁸ By contrast, while there are tools that Android OEMs offer to attempt to facilitate switching from iPhones, they are generally viewed as more complicated.⁶⁹
4. Many iPhone users have networks of family and friends with whom they communicate using proprietary Apple technologies that would not be available on Android. For example, iMessage provides an enhanced version of text messaging that only works on Apple devices and is highly valued by iPhone users.⁷⁰ Other apps, such as FaceTime

⁶⁷ Andrew Cunningham, "iPhone vs. Android: Which Is Better for You?" The New York Times, October 31, 2019, <https://www.nytimes.com/wirecutter/reviews/ios-vs-android/> ("When buying a phone, we generally recommend sticking with the same platform your current phone uses. At a minimum, switching entails learning the quirks of a new interface and potentially losing access to purchased apps, app-specific data, or even photo and data services"); Michelle Yan, "Here's why it's so hard to switch from Apple to Android," Business Insider, June 10, 2019, <https://www.businessinsider.com/apple-to-android-switch-new-phone-stuck-ecosystem-2019-6> ("And speaking of apps, you may have trouble transferring those too. For the most part, you'll have to redownload them individually, and you might need to repurchase iOS apps on the Play Store."); JR Raphael, "iPhone to Android: The ultimate switching guide," Computer World, February 7, 2020, <https://www.computerworld.com/article/3218067/how-to-switch-from-iphone-to-android-ultimate-guide.html> ("The bad news: Any apps you've installed on your iPhone won't automatically transfer over to Android, and any apps you've paid for on iOS will likely have to be purchased again."). In the case of apps that are available on both iOS and Android, an iPhone user switching to Android would retain access to pre-purchased content if that content were synchronized across platforms by the developer.

⁶⁸ An existing iPhone user who has iOS 12.4 or later on her current and new iPhone can use Apple's iPhone migration to transfer all of her data wirelessly from the previous device to the new one. An existing iPhone user who has iOS 11 or later can use Quick Start to set up her new device by using her Apple ID or Bluetooth. The Quick Start process includes the choice of restoring apps, data, and settings from the user's most recent iCloud backup if they are connected through Wi-Fi.

⁶⁹ Gordon Gotsegen, "How to Switch From Android to iOS (and Vice Versa)," Wired, October 6, 2015, <https://www.wired.com/2015/10/how-to-switch-android-ios/> ("Switching between different OSes is more complicated than upgrading to the newest iPhone/Galaxy from your old one."); JR Raphael, "iPhone to Android: The ultimate switching guide," Computer World, February 7, 2020, <https://www.computerworld.com/article/3218067/how-to-switch-from-iphone-to-android-ultimate-guide.html> ("Of course, these all-in-one [iPhone-to-Android switching systems] methods aren't available for every phone, and they don't always work flawlessly or across all of the areas relevant to your needs.").

⁷⁰ Joanna Stern, "Ugh, Green Bubbles! Apple's iMessage Makes Switching to Android Hard," The Wall Street Journal, October 18, 2018, <https://www.wsj.com/articles/ugh-green-bubbles-apples-imessage-makes-switching-to-android-hard-1539867600> ("That is still what makes blue-bubble [iMessage] conversations so much better than green-bubble [SMS text message] ones. Not only do you get more functionality inside the messaging window, you can pick up the conversation from one device to the next—iPhone to MacBook to Apple Watch. It also means things turn into a nightmare hell ride whenever I assign my phone number to a non-Apple phone."); Andrew Cunningham, "iPhone vs. Android: Which Is Better for You?" October 31, 2019, The New York Times, <https://www.nytimes.com/wirecutter/reviews/ios-vs-android/> ("You also won't be able to communicate with iOS

(which provides video and audio communications), Find My (which allows for the tracking of the location of Apple devices), and AirDrop (which allows the transfer of files among supported Mac computers and iOS devices without using e-mail or a mass storage device) allow users to connect with their friends and family, but can't be used on Android smartphones.⁷¹

5. iPhone users who are connected to Apple services, such as iCloud Photos, iCloud Drive, Apple News, and Apple TV+, would effectively lose access to those services if they switched to an Android smartphone.⁷² A user who had stored all her family photos on iCloud would need to download and transfer them to an Android smartphone that is likely unfamiliar to her. These frictions pose significant costs to everyday smartphone users.⁷³
6. iPhone users who have other Apple devices, such as iPads and MacBooks, use Apple apps and services across their Apple devices, such as iMessage, FaceTime, AirDrop, Find My, iCloud Photos, iCloud Drive, Apple News, and Apple TV+. For example, a user can have the same iMessage conversation and view the same iCloud Photo libraries

users using iMessage or FaceTime, which can be a big sticking point if you have a lot of iPhone-using friends and family.”).

⁷¹ Apple, “Find My,” <https://www.apple.com/icloud/find-my/> (“The new Find My app combines Find My iPhone and Find My Friends into a single, easy-to-use app on iOS, iPadOS, and now macOS.”); Apple, “FaceTime,” <https://apps.apple.com/us/app/facetime/id1110145091>, (“This app is available only on the App Store for iPhone and iPad.”); Apple, “How to use AirDrop on your iPhone, iPad, or iPod touch,” <https://support.apple.com/en-us/HT204144> (“Use AirDrop to share and receive photos, documents, and more with other Apple devices that are nearby.”); Michelle Yan, “Here’s why it’s so hard to switch from Apple to Android,” Business Insider, June 10, 2019, <https://www.businessinsider.com/apple-to-android-switch-new-phone-stuck-ecosystem-2019-6> (“[I]t’s hard to say goodbye to AirDrop. You’ll no longer be able to conveniently send files from your iPhone to your MacBook, to your iPad, or to another person’s Apple device. . . . Switching to Android also means losing all of Apple’s preinstalled apps. There may be a good chunk you don’t use, but think about FaceTime. You’ll have to use another app to video call people, like Facebook Messenger or Google Duo, which also means getting whoever you want to call to use those apps as well.”).

⁷² Less functional access to iCloud Photos and Apple TV+ is available through a browser-based application on Android. See Andrew Cunningham, “iPhone vs. Android: Which Is Better for You?”, The New York Times, October 31, 2019, <https://www.nytimes.com/wirecutter/reviews/ios-vs-android/> (“Apple Music aside, Apple makes it difficult to impossible to use iCloud services or access your media on non-Apple devices.”); Daniel Nations, “How to Access Your iCloud Photos From Apple, Windows, and Android Devices,” Lifewire, April 27, 2020, <https://www.lifewire.com/access-your-icloud-photos-4160237>; David Nield, “Get more from AppleTV+ with these easy tricks,” Popular Science, February 5, 2020, <https://www.popsoci.com/story/diy/appletv-tips/>; Phillip Prado, “How to use Apple iCloud on your Android device,” Android Authority, February 5, 2020, <https://www.androidauthority.com/how-to-use-icloud-for-android-1080681/>.

⁷³ Michelle Yan, “Here’s why it’s so hard to switch from Apple to Android,” Business Insider, June 10, 2019, <https://www.businessinsider.com/apple-to-android-switch-new-phone-stuck-ecosystem-2019-6> (“There’s no iCloud app for Android, meaning there’s no easy way for you to transfer all of your iCloud data to your Android.”).

on her iPhone, iPad, or MacBook. She would lose that functionality if she switched to an Android smartphone.⁷⁴

7. iPhone users switching to Android would lose the use of all or much of the functionality of many peripherals they had previously purchased. For example, an Apple Watch cannot be connected to an Android smartphone and AirPods have significantly less functionality when used with an Android smartphone.⁷⁵ And the stock of lightning cables that many families have accumulated would not be useful for an Android smartphone.
8. Apple provides for family sharing of purchased apps and content, Apple Music (streaming music), Apple TV+ (streaming video content), iTunes content (downloadable music and video), Apple Books (e-books), Apple Arcade (gaming apps), iCloud storage, and shared family photos.⁷⁶ Up to six family members can share content on their iPhones and other Apple devices. If one family member switches from an iPhone to an Android smartphone, she loses access to that content.⁷⁷

d. Entry Barriers

47. Entry, or the threat of entry, into the smartphone software platform market would not likely constrain Apple's market power. Nowadays, there are significant barriers to entry.

48. Because of fixed costs of developing and marketing apps, most app developers will only write for smartphone software platforms that have enough users. And most consumers will only use smartphone software platforms that have a large enough number of apps to ensure availability of the apps they will want to use. Most users have already made sunk cost

⁷⁴ Michelle Yan, "Here's why it's so hard to switch from Apple to Android," Business Insider, June 10, 2019, <https://www.businessinsider.com/apple-to-android-switch-new-phone-stuck-ecosystem-2019-6> ("[I]t's hard to say goodbye to AirDrop. You'll no longer be able to conveniently send files from your iPhone to your MacBook, to your iPad, or to another person's Apple device.").

⁷⁵ Sydney Butler, "Can you use an Apple Watch with Android phones?," 9to5Google, December 2, 2019, <https://9to5google.com/2019/12/02/how-to-use-apple-watch-android/>; Karissa Bell, "AirPods Pro and Android: Is it worth it?," Mashable, November 2, 2019, <https://mashable.com/article/do-airpods-pro-work-with-android/>.

⁷⁶ Apple, "Family Sharing," <https://www.apple.com/family-sharing/>. Family Sharing requires an iCloud Storage subscription with at least 200GB.

⁷⁷ Some Apple content, such as most apps from the App Store, Apple TV+, Apple Arcade, and iTunes content, can be shared with family members with no additional charges beyond the Family Sharing subscription. Other content requires an additional fee, but it is less than the fee for a second standalone subscription. For example, for Apple Music, an individual subscription costs \$9.99 monthly, while a family sharing subscription costs \$14.99 monthly, so removing a family member from the plan saves no money if two or more family members remain on the plan, and only \$5 if there is only one remaining family member who then converts to the individual plan. In-app purchases, some third-party subscriptions, and some apps from the App Store are not available for family sharing. See Apple, "Apple Music," <https://www.apple.com/apple-music/>; Apple, "What types of content can I share with my family using purchase sharing?" <https://support.apple.com/en-us/HT203046>.

investments into handsets for the two incumbent providers. These facts make successful new entry difficult because the entrant has to try to bring enough members of both sides (users and developers) on board simultaneously in the face of sunk investments by the current installed base.

49. Competing smartphone platforms have exited largely because they could not attract enough users and developers to make the platform compelling for either. And there has been no material entry in recent years. It is not likely that entry, or the threat of entry, would prevent Apple from having significant market power over users and developers in the upstream relevant antitrust market for smartphone software platforms.

e. Preliminary Conclusion on Market Power in Smartphone Software Platforms

50. It is likely that I will conclude, based on further economic analysis of this and other evidence, that Apple has substantial market power over iOS users and developers who want to write apps for these users in the market for smartphone software platforms.

C. Analysis of Market Definition and Market Power for App Distribution

51. With this background concerning Apple's market power in smartphone software platforms, I turn to the downstream distribution of apps.

1. Market Definition for App Distribution

52. Consider the situation in which there are several app stores available on iOS devices that developers could rely on to distribute iOS apps and that iOS users could use to obtain iOS apps.⁷⁸ Those iOS app stores would likely not face substantial competitive constraints on their prices, or the quality of the services to users and developers, from app stores for Android apps.

53. The developers would not be able to use Android app stores to reach iOS users and iOS users would not be able to rely on Android app stores to obtain iOS-compatible apps.⁷⁹ iOS users would also incur significant costs of switching to an Android device that would enable

⁷⁸ The market for iOS app distribution may also include ways in which apps could be directly distributed to consumers other than through app stores.

⁷⁹ See Sections II.A.1, II.A.4.

them to use an Android app from an Android app store.⁸⁰ Other software platforms would not provide substantial competitive constraints either.⁸¹

54. It is therefore likely that a hypothetical monopolist of iOS app distribution would be able to raise the overall costs, or reduce the overall quality, of app distribution services to users and developers. That is especially likely if developers cannot distribute iOS apps directly to iOS users. Therefore, there is a relevant antitrust market for app distribution for iOS apps.⁸²

2. Apple's Market Power over App Distribution for the iOS Software Platform

55. As a result of Apple's restrictions, the Apple App Store is a monopoly supplier of iOS app distribution. The Apple App Store is the only way that iPhone users can obtain iOS-compatible apps and is the only way that developers can distribute apps to iPhone users. Developers cannot avoid using the Apple App Store to interact with the approximately 1 billion iPhone users worldwide and therefore many potential customers. Users cannot avoid using the Apple App Store to obtain iOS apps. Given the lack of interchangeability of iOS and Android for users and developers, switching costs from iOS to Android, and entry barriers in the upstream market for smartphone software platforms, it does not appear likely that Apple faces material competitive constraints on its monopoly power in app distribution for the iOS software platform.

56. Apple's ability to impose terms and conditions on app developers is consistent with its having monopoly power over app distribution for iOS apps. Apple requires all developers of digital content apps that wish to use its App Store, the only allowed method of distributing apps on iOS devices, to use exclusively Apple's own payment processing platform for all in-app purchases and prohibits the developer from redirecting consumers to payment options outside

⁸⁰ See Section II.B.2.c.

⁸¹ See Section II.B.2.

⁸² The participants in this app distribution market could operate two-sided marketplaces that rely on indirect network effects between buyers and sellers, or they could operate more traditional retail stores for which indirect network effects are not substantial. In addition, it is possible that this app store market could include direct app distribution as an element. Further analysis would need to consider the importance of indirect network effects and the relative importance of stores that follow two-sided versus single-sided models. My preliminary conclusions are unlikely to depend on whether the app distribution market is treated as two-sided, single-sided, or a hybrid or on considering users and developers together or separately. At least in terms of prices, the interests of users and developers are aligned as a result of the pass-through of developer distribution costs to users.

of the app.⁸³ Apple enforces these terms as evidenced when Apple threatened to remove Spotify's app from the App Store for advertising free trials to its customers.⁸⁴ Additionally, Apple has rejected gaming apps from Microsoft and Facebook because the apps did not meet Apple's terms, which require games be submitted individually for review and appear in charts and search.⁸⁵

57. Given these considerations, it is likely that I will conclude, based on further economic analysis of this and other evidence, that Apple has monopoly power in the market for distribution of iOS apps.

III. In-App Payment Processing is a Separate Product from the App Store

58. iOS developers can decide to make their iOS app available to iOS users for free (that is, there is no upfront charge for the app). The consumer presses a "GET" button and authenticates her identity if asked, after which the app is installed. iOS developers can also decide to make

⁸³ Complaint for Injunctive Relief, Exhibit A, *Epic Games, Inc. vs Apple Inc.*, Case No. 3:20-cv-05640-YGR, ECF No. 1 at 81 (August 12, 2020) (Apple Developer Program License Agreement at 3.2(g)) ("Applications for iOS Products, Apple Watch, or Apple TV developed using the Apple Software may be distributed only if selected by Apple (in its sole discretion) for distribution via the App Store, Custom App Distribution, for beta distribution through TestFlight, or through Ad Hoc distribution as contemplated in this Agreement."); Apple, "App Store Review Guidelines," <https://developer.apple.com/app-store/review/guidelines/>, at 3.1.1 ("If you want to unlock features or functionality within your app, (by way of example: subscriptions, in-game currencies, game levels, access to premium content, or unlocking a full version), you must use in-app purchase. Apps may not use their own mechanisms to unlock content or functionality, such as license keys, augmented reality markers, QR codes, etc. Apps and their metadata may not include buttons, external links, or other calls to action that direct customers to purchasing mechanisms other than in-app purchase."); *id.* at 1.1.3(b) ("You must not directly or indirectly target iOS users to use a purchasing method other than in-app purchase, and your general communications about other purchasing methods must not discourage use of in-app purchase."). There is a very limited exception to this requirement. *See* Nick Statt, "Apple now lets some video streaming apps bypass the App Store cut," The Verge, April 1, 2020, <https://www.theverge.com/2020/4/1/21203630/apple-amazon-prime-video-ios-app-store-cut-exempt-program-deal> ("Apple has an established program for premium subscription video entertainment providers to offer a variety of customer benefits — including integration with the Apple TV app, AirPlay 2 support, tvOS apps, universal search, Siri support and, where applicable, single or zero sign-on," the company said. "On qualifying premium video entertainment apps such as Prime Video, Altice One and Canal+, customers have the option to buy or rent movies and TV shows using the payment method tied to their existing video subscription.").

⁸⁴ Spotify, "A Timeline: How We Got Here," <https://www.timetoplayfair.com/timeline/>.

⁸⁵ Nick Statt, "Apple confirms cloud gaming services like xCloud and Stadia violate App Store guidelines," The Verge, August 6, 2020, <https://www.theverge.com/2020/8/6/21357771/apple-cloud-gaming-microsoft-xcloud-google-stadia-ios-app-store-guidelines-violations>; Seth Schiesel, "Facebook Gaming Finally Clears Apple Hurdle, Arriving in App Store," The New York Times, August 7, 2020, <https://www.nytimes.com/2020/08/07/technology/facebook-gaming-app-store.html>.

their iOS apps available to iOS users for a fee (that is, there is an upfront charge).⁸⁶ The consumer presses a purchase button displaying the amount of the upfront charge, authenticates her identity if asked, and pays using the App Store's payment processing method, after which the app is installed.

59. For some apps, developers sell products and services while the consumer is using the app on the software platform. There are three main circumstances in which this happens.⁸⁷ "Physical apps", such as Uber, enable app users to purchase physical goods and services while using the app. "Digital content apps," such as Fortnite, enable app users to purchase digital content and services while using the apps. "Ad-supported apps," such as Instagram, serve ads to users while they are using the app and charge advertisers for that service.

60. In the case of physical and digital content apps, the app developer needs to provide a payment processing mechanism that enables the user of the app to complete a transaction while using the app. Physical apps typically rely on third-party payment processors to handle payments. In the case of digital content apps, however, Apple requires that the developer use Apple's In-App Purchase (IAP) payment processing for in-app transactions, with very limited exceptions.⁸⁸

61. This section explains the basis for my preliminary conclusion that the provision of payment processing of in-app transactions is a separate product for which there is material demand by developers of apps with in-app transactions.

⁸⁶ Apple, "Choosing a Business Model," <https://developer.apple.com/app-store/business-models/>.

⁸⁷ Apple, "Choosing a Business Model," <https://developer.apple.com/app-store/business-models/>; Apple, "App Store Review Guidelines," Section 3, <https://developer.apple.com/app-store/review/guidelines/#business>.

⁸⁸ Apple, "App Store Review Guidelines," Section 3, <https://developer.apple.com/app-store/review/guidelines/#business>; Nick Statt, "Apple now lets some video streaming apps bypass the App Store cut," The Verge, April 1, 2020, <https://www.theverge.com/2020/4/1/21203630/apple-amazon-prime-video-ios-app-store-cut-exempt-program-deal> ("Apple has an established program for premium subscription video entertainment providers to offer a variety of customer benefits — including integration with the Apple TV app, AirPlay 2 support, tvOS apps, universal search, Siri support and, where applicable, single or zero sign-on," the company said. "On qualifying premium video entertainment apps such as Prime Video, Altice One and Canal+, customers have the option to buy or rent movies and TV shows using the payment method tied to their existing video subscription."").

A. Payment Processing

62. In general, a number of steps take place between when a consumer pays a merchant with a card until the merchant gets funds deposited into its bank account. At a high level, a payment processor is a business that coordinates those steps and instructs its bank to pay the merchant. Various businesses, such as the card networks, that are involved in these steps charge fees. The payment processor charges these fees, along with its own fee for serving as an intermediary, to the merchant.

63. Special payment processing considerations arise when purchases are made using a web browser or in smartphone apps. Unlike physical merchants, website and software developers are interacting with customers through software, often on a global basis. Developers look for processors that offer a simple and efficient onboarding and integration process, support multiple currencies and local acquiring and processing relationships, support the mix of payment methods that consumers have available to them and like to use, offer fraud protection, comply with regulatory and data security and privacy requirements, have modern chargeback and dispute policies and technology, and deposit funds into their accounts quickly.⁸⁹

64. Dealing with these and other considerations has resulted in the emergence of payment processors that specialize in online transactions by consumers using web browsers or mobile apps. Significant innovations have occurred in this area to meet the needs of the digital economy. Some of these new processors, such as Stripe and Braintree, specialize in payment processing for mobile apps.⁹⁰ Payment processors also include platforms, such as PayPal, which enable consumers to store their payment card credentials securely and then process transactions for online merchants using these credentials.

⁸⁹ Tom Ewer, “How to Select a Payment Processor for Your Online Store,” Woo Commerce, <https://woocommerce.com/posts/online-store-payment-processor/>; BigCommerce, “How to Choose a Payment Processor,” <https://www.bigcommerce.com/ecommerce-answers/how-choose-payment-processor/>; The Digital Merchant, “How to Find the Best Payment Processor for Your Online Business,” <https://thedigitalmerchant.com/how-to-find-the-best-payment-processor/>.

⁹⁰ Miguel Helft, “How John and Patrick Collison Built Stripe into the PayPal of the Mobile Era,” Forbes, January 4, 2016, <https://www.forbes.com/sites/miguelhelft/2016/01/04/cashiers-of-the-internet/>; Amit Chodhry, “eBay Buys Braintree For \$800 Million To Accelerate Its Mobile Payments Revenue,” Forbes, September 26, 2013, <https://www.forbes.com/sites/amitchowdhry/2013/09/26/ebay-buys-chicago-based-braintree-for-800-million/>.

65. Website and software developers may rely on several payment processors to give consumers more choice in how they pay (for example, using a Visa card or a PayPal account). In the case of in-app payments, the app developer typically uses an API from the payment processor to integrate payment acceptance and processing into its app. The payment processor then takes care of in-app payments.⁹¹ Like any processor, it reimburses the developer minus applicable fees.⁹²

66. The existence of this vibrant third-party payment processing industry demonstrates the existence of material demand for these services by developers.

B. Separate Product Analysis

67. Both Apple and Google allow developers whose apps can be used to make purchases of physical goods and services to use payment processors chosen by the developer for those transactions.⁹³ Additionally, Google allows developers of non-gaming apps that enable users to buy digital goods that can also be consumed outside of the app to use payment processors chosen by the developer for those transactions.⁹⁴ Apple provides an even more limited exception for movies and TV shows sold by premium subscription video entertainment providers.⁹⁵

⁹¹ In general, aside from the API, which provides a link to the payment processor, and the registration of payment credentials, payment processing takes place entirely off of the smartphone software platform and associated device. SignifyD, “How Online Payments Work,” <https://www.signifyd.com/resources/fraud-101/how-online-payments-work/>.

⁹² The total fees vary but are typically less than 5 percent of the purchase price. The following sources provide the range for payment processing for the web and in-app purchases. Joe Resendiz, “Best Online Credit Card Processing in 2020,” ValuePenguin, June 23, 2020, <https://www.valuepenguin.com/credit-card-processing/best-online-credit-card-processing>; Braintree, “Pricing,” <https://www.braintreepayments.com/braintree-pricing>; PayPal, “Fees for Selling and Accepting Payments,” <https://www.paypal.com/us/webapps/mpp/merchant-fees>; Magdalena Brych, “Micropayments: How They Can Work Within Your App,” Espeo Software, <https://espeo.eu/blog/micropayments/>. My understanding is that the effective rate paid to payment processors by Epic in 2019 was less than 5 percent of revenues.

⁹³ Apple, “App Store Review Guidelines,” <https://developer.apple.com/app-store/review/guidelines/>; Google, “Play Console Help, Policy Center, Payments,” <https://support.google.com/googleplay/android-developer/answer/9858738>.

⁹⁴ Google, “Play Console Help, Policy Center, Payments,” <https://support.google.com/googleplay/android-developer/answer/9858738>.

⁹⁵ Nick Statt, “Apple now lets some video streaming apps bypass the App Store cut,” The Verge, April 1, 2020, <https://www.theverge.com/2020/4/1/21203630/apple-amazon-prime-video-ios-app-store-cut-exempt-program-deal> (“Apple has an established program for premium subscription video entertainment providers to offer a variety of

68. Where there are no restrictions imposed by Apple or Google, app developers typically rely on payment processing that are not supplied by Apple or Google.⁹⁶ The following are examples of payment processors used for in-app purchases of physical goods and services for both iOS and Android: PayPal provides payment processing for Grubhub and Wish;⁹⁷ Braintree provides in-app payment processing for Snapfish, Stubhub, and Uber;⁹⁸ and Stripe provides in-app payment processing for DoorDash, Lyft, Instacart, and PostMates.⁹⁹ Other major apps used for the purchase of physical goods and services that use payment processors other than that provided by the app store include apps from major e-commerce firms such as Amazon, Walmart, eBay, and Target.¹⁰⁰

69. For digital goods, app developers also choose payment processors that are provided separately from the app store when permitted. In the case of the Google Play Store, which allows for sellers of digital goods that can be consumed outside of the app to use alternative payment processors, the following are examples of apps that use payment processors other than that provided by the app store for in-app purchases of digital content: Disney+, HBO Max, Hulu, Netflix, Pandora, and Spotify.¹⁰¹ Apple also provides an exception that enables “qualifying premium video entertainment apps such as Prime Video, Altice One and Canal+” to charge movies and TV shows using their own payment processor, which they do.¹⁰²

customer benefits — including integration with the Apple TV app, AirPlay 2 support, tvOS apps, universal search, Siri support and, where applicable, single or zero sign-on,” the company said. “On qualifying premium video entertainment apps such as Prime Video, Altice One and Canal+, customers have the option to buy or rent movies and TV shows using the payment method tied to their existing video subscription.”).

⁹⁶ The following list of apps is taken from customer lists posted on each processor’s website. Just because an app developer is a customer of a payment processor, it does not necessarily follow that it uses that payment processor for its mobile app (because both the app provider and the payment processor are multiplatform businesses). Therefore, I directed my staff to verify that each of these apps allows a payment mechanism other than Google’s in-app payment solution on an Android smartphone and other than Apple’s in-app payment solution on an iPhone.

⁹⁷ PayPal, “PayPal Commerce Platform for enterprises,” <https://www.paypal.com/us/business/enterprise>.

⁹⁸ Braintree, “Braintree Merchants,” <https://www.braintreepayments.com/learn/braintree-merchants>.

⁹⁹ Stripe, “Customers,” <https://stripe.com/customers>.

¹⁰⁰ Staff under my direction confirmed that a non-Apple payment option was available on the iOS version of these apps and a non-Google payment option was available on the Android version of these apps.

¹⁰¹ Staff under my direction confirmed that a non-Google payment option was available on Android for each of these apps. For Hulu and Spotify, see also PayPal, <https://www.paypal.com/us/business/enterprise>.

¹⁰² The Verge, “Apple now let’s some video streaming apps bypass the App Store cut,” April 1, 2020, <https://www.theverge.com/2020/4/1/21203630/apple-amazon-prime-video-ios-app-store-cut-exempt-program-deal>

70. There is therefore material demand by developers to use third-party payment processing services for in-app transactions in the absence of restrictions.

71. For in-app purchases of digital content, Apple requires, other than for the just-mentioned exception, that developers use its IAP payment processor. Using the card (or other payment method) that the iOS user has registered with Apple, Apple processes the transaction and reimburses the developer minus applicable fees. In effect, Apple requires that the developer, for apps that offer in-app purchases of digital content, use Apple's payment processing method rather than the developer's own method which relies on third-party payment processors. This requirement has the further effect of making Apple the merchant, and the user Apple's customer, for that transaction for the purpose of anything related to payments.¹⁰³

72. Developers who are subject to these restrictions have expressed their interest in using third-party processors or their own payment processing solutions for in-app purchases of digital content rather than Apple's IAP payment processor.¹⁰⁴ That further supports the existence of material demand for using third-party payment processors for in-app transactions.

("Apple on Wednesday confirmed the existence of a program for streaming video providers that allows those platforms to bypass its standard 30 percent App Store fee when selling individual purchases, like movie downloads and TV show rentals. The program first became public earlier today when Amazon updated its Prime Video iOS and Apple TV apps to allow in-app purchases for the first time... 'Apple has an established program for premium subscription video entertainment providers to offer a variety of customer benefits — including integration with the Apple TV app, AirPlay 2 support, tvOS apps, universal search, Siri support and, where applicable, single or zero sign-on,' the company said. 'On qualifying premium video entertainment apps such as Prime Video, Altice One and Canal+, customers have the option to buy or rent movies and TV shows using the payment method tied to their existing video subscription.'"); The Wall Street Journal, "How App Makers Break Their Apps to Avoid Paying Apple," June 28, 2020, <https://www.wsj.com/articles/how-app-makers-break-their-apps-to-avoid-paying-apple-11593349200> ("On iPhones, the notable exception is Amazon Prime Video. The app historically circumvented commissions by not offering entertainment rentals or purchases to iOS users. In April, Amazon began using its own payment system to fulfill the purchases. According to Apple, Amazon is in a program for 'premium video providers' permitted to use the payment method tied to customers' existing video subscriptions. Two European entertainment companies, Altice One and Canal+, are also in the program.").

¹⁰³ HEY, "Our CEO's take on Apple's App Store payment policies, and their impact on our relationship with our customers," June 19, 2020, <https://hey.com/apple/iap/> ("When someone signs up for your product in the App Store, they aren't technically your customer anymore - they are essentially Apple's customer . . . You can no longer help the customer who's buying your product with the following requests: Refunds, credit card changes, discounts, trial extensions, hardship exceptions, comps, partial payments, non-profit discounts, educational discounts, downtime credits, tax exceptions, etc. You can't control any of this when you charge your customers through Apple's platform. So now you're forced to sell a product - with your name and reputation on it - to your customers, yet you are helpless and unable to help them if they need a hand with any of the above.").

¹⁰⁴ Daniel Ek, "Consumers and Innovators Win on a Level Playing Field," Spotify Newsroom, March 13, 2019, <https://newsroom.spotify.com/2019-03-13/consumers-and-innovators-win-on-a-level-playing-field>; Reed Albergetti and Tony Romm, "Tinder and Fortnite criticize Apple for its 'App Store monopoly'," The Washington

73. Therefore, in the absence of Apple's restrictions, there would likely be material demand by iOS developers for using third-party processors to provide payment processing services for in-app purchases of digital content. As an economic matter, payment processing for in-app transactions in iOS apps is a separate and distinct product from the App Store.^{105, 106}

C. Market Definition

74. It is likely that I will conclude, based on further economic analysis of this and other evidence, that Apple has monopoly power in a relevant market of payment processing services for in-app purchases of digital content for iOS apps. Apple's restrictions prevent third-parties from offering payment processing services for in-app purchases of digital content for iOS apps so that those alternatives cannot constrain Apple's monopoly power in this market.¹⁰⁷ In the absence of Apple's restrictions, I would expect that third-party payment processors would compete, along with Apple's IAP payment processing solution, to provide payment processing

Post, June 16, 2020, <https://www.washingtonpost.com/technology/2020/06/16/apple-antitrust-european-commission/>.

¹⁰⁵ In its opposition to Epic's motion for a temporary restraining order, Apple appears to argue, citing my book with Richard Schmalensee, that distribution and payment processing cannot be separate products because the App Store is a two-sided transaction platform. See Defendant Apple Inc.'s Opposition to Epic Games, Inc.'s Motion for a Temporary Restraining Order and Order to Show Cause Why a Preliminary Injunction Should Not Issue, *Epic Games, Inc. v. Apple, Inc.*, Case No. 3:20-cv-05640-YGR, ECF No. 36, at 19 (August 21, 2020). A two-sided transaction platform, just like a single-sided retail store, provides check-out involving payment processing. But, whether a transaction platform is one sided or two-sided, payment processing is an input that the business relies on to facilitate payment. The issue of whether there is material demand for payment processing for in-app transactions does not turn, in any apparent way, on whether the store itself is deemed to be two-sided or one-sided. For example, PayPal used to be part of eBay, a two-sided marketplace, and served as the exclusive payment processing method for eBay transactions. When it was part of eBay, it also provided the same payment processing services to online third-party merchants, many of whom were traditional retailers, that were not on eBay. Now it's not part of eBay and provides payment processing to online merchants regardless of whether they have a traditional or two-sided business model. And eBay relies on other payment processors to process payments. There was, and is, material demand for PayPal's payment processing service separate from the two-sided marketplaces or retailers it works with.

¹⁰⁶ Apple might argue that it couldn't offer digital content apps that provide in-app purchases in the absence of these restrictions and therefore the provision of App Store services to these developers is not a viable product. At least as an economic matter, this does not appear compelling. Apple chooses not to charge anything for most apps likely because doing so helps drive its device sales. While digital content developers could theoretically avoid paying the App Store by offering their apps for free and then selling things in-app, they can do the same thing under Apple's rules right now by offering their apps for free and earning revenue from in-app advertising.

¹⁰⁷ US Department of Justice and Federal Trade Commission, "Horizontal Merger Guidelines," August 19, 2010, Sections 3, 4.1.4, https://www.ftc.gov/system/files/documents/public_statements/804291/100819hmg.pdf ("If a hypothetical monopolist could profitably target a subset of customers for price increases, the Agencies may identify relevant markets defined around those targeted customers, to whom a hypothetical monopolist would profitably and separately impose at least a SSNIP.").

services for in-app purchases of digital content for iOS apps. At a minimum, these alternative sources of supply include Amazon Pay, Authorize.net, Braintree, Chase Merchant Services, PayPal, Square, Stripe, and Xsolla.¹⁰⁸

¹⁰⁸ Amazon Pay, “A solution for web and mobile,” <https://pay.amazon.com/how-it-works/web-mobile>; Authorize.net, “Mobile Payments,” <https://www.authorize.net/payments/mobile-payments.html>; Braintree, “Braintree Direct,” <https://www.braintreepayments.com/products/braintree-direct>; Chase Merchant Services, “Integrated Solutions,” <https://merchantservices.chase.com/payment-solutions?tab=integrated-solution>; PayPal, “Accept credit cards online,” <https://www.paypal.com/us/webapps/mpp/accept-credit-cards>; Square, “Secure online payments services,” <https://squareup.com/us/en/payments/online-payments>; Stripe, “One platform to cover your payment needs” <https://stripe.com/payments/features#mobile>; Xsolla, “Pay Station,” <https://xsolla.com/products/paystation>.

Pursuant to 28 U.S.C. § 1746, I, David S. Evans, declare under penalty of perjury that the foregoing is true and correct and that I executed this declaration on September 4, 2020 in Marblehead, Massachusetts.

A handwritten signature in dark ink, appearing to read "DSE", is positioned above a horizontal line.

APPENDIX A: CURRICULUM VITAE

David S. Evans

Curriculum Vitae **Competition Policy and Regulation**

Contact Details

Address: Global Economics Group
111 Devonshire St.
Boston, Mass 02109

Mobile: 1 (617) 320 8933
Skype: david.s.evans
Email: devans@globaleconomicsgroup.com

SSRN: [SSRN Home Page for David S. Evans](#)
IDEAS: [IDEAS Home Page for David S. Evans](#)

Professional Summary

My academic work has focused on industrial organization, including antitrust economics, with a particular expertise in multisided platforms, digital economy, information technology, and payment systems. I have authored six major books, including two award winners, and more than 100 articles in these areas. I have developed and taught courses related to antitrust economics, primarily for graduate students, judges and officials, and practitioners, and have authored handbook chapters on various antitrust subjects.

My expert work has focused on competition policy and regulation. I have served as a testifying or consulting expert on many significant antitrust matters in the United States, European Union, and China. I have also made submissions to, and appearances before, competition and regulatory authorities with respect to mergers and investigations in those and other jurisdictions. I have worked on litigation matters for defendants and plaintiffs, on mergers for merging parties and intervenors, and for and in opposition to competition authorities.

Representative Matters

T-Mobile acquisition of Sprint. Submitted declaration to the FCC concerning the dynamic effects of the proposed merger on cellular data prices and capacity, the competitive investment of other carriers, and the likely value of 5G capacity.

Apple v. Qualcomm. Testimony on behalf of Qualcomm to assess the economic impact of modern cellular technologies on the growth of the smartphone ecosystem, the economic

relevance of the value of modern cellular technologies for licensing negotiations concerning patents involving modern cellular technologies that are subject to a fair, reasonable, and non-discriminatory (FRAND) commitment under European Telecommunications Standards Institute (ETSI) intellectual property rights (IPR) policies, and to evaluate the impact of modern cellular technologies on Apple's revenues and the profits. Expert reports and deposition testimony (October 2018).

Federal Trade Commission v. 1-800 Contacts. Testimony on behalf of the FTC concerning the competitive effects of agreements between 1-800 Contacts and other online sellers of contact lenses that restricted certain forms of search advertising. Expert report and trial testimony on the economics of search engines and search advertising, market definition, and competitive effects. (April 2017).

Comcast's Proposed Acquisition of Time Warner Cable. On behalf of Netflix, submitted multiple declarations to the Federal Communications Commission in opposition to the merger and made appearances before the Federal Communications Commissions and U.S. Department of Justice. (July 2014-April 2015).

Qihoo 360 v. Tencent. Written testimony in support of Tencent before the Supreme People's Court, People's Republic of China, concerning Qihoo 360's market definition and abuse of dominance claims against Tencent. This was the first antitrust matter decided under the Anti-Monopoly Law by the Supreme Court of China. (September 2013)

Federal Reserve Board Debit Card Interchange Fees and Routing Rulemaking Procedure. Written submissions on behalf of a group of financial institutions concerning the Federal Reserve Board's preliminary proposed rules concerning debit interchange fees. (January – June 2011).

European Commission v. Microsoft. Oral testimony and written submissions before the Grand Chamber, European Court of First Instance (now the European General Court) on behalf of Microsoft concerning economic aspects of the European Commission's Decision that Microsoft had abused its dominant position with respect to media players and server interoperability. Made several appearances of various topics over five days. (April 2006).

Professional Positions

Global Economics Group (2011-present)
Chairman

Market Platform Dynamics (2004-present)
Founder

Competition Policy International (2004-present)
CEO/Publisher

University College London (2004-present)

Executive Director, Jevons Institute for Competition Law and Economics
Visiting Professor in the Faculty of Laws

University of Chicago Law School (2006-2016)

Lecturer

LECG, LLC (2004-2011)

Vice Chairman, LECG Europe
Head, Global Competition Policy Practice
Member of the Boards of Directors of various subsidiaries

NERA Economic Consulting (1988-2004)

Senior Vice President
Member of the Management Committee
Member of the Board of Directors

Fordham University (1983-1995)

Professor of Law, Fordham University Law School (1985-1995)
Associate Professor of Economics (1983-1989) (tenured as of 1988)

Charles River Associates (1975-1979)

Senior Consultant

Education

Ph.D., MA Economics, University of Chicago, 1983

B.A. Economics, University of Chicago, 1975 (completed first year of graduate program)

Teaching and Editorships

Teaching

University College London: “Multisided Platforms: Business Economics & Competition Policy,” intensive course taught annually since 2014; “Digital Economy: Economics, Antitrust & Regulation,” intensive course taught annually since 2016 at University College London; “The Role of Economics in Competition Law and Economics”, annual course taught 2005-2011.

University of Chicago, “EC Competition Law and Economics,” Spring quarter seminar course taught 2006-2016.

Competition Policy International, “Antitrust Economics,” 32 lecture online course, offered in 2013-2014.

Training for Judges and Officials

Training courses on antitrust law and economics for Chinese Supreme Court and High Court Judges, sponsored by Ministry of Industry and Information Technology, 2013-15; lectures on market definition, tying, platforms, dynamic competition and innovation, and antitrust of online industries.

Faculty, Training courses on antitrust law and economics for European Judges, sponsored by University College London and University of Toulouse, 2009-2010; lectures on basic economics and antitrust and intellectual property.

Honors and Rankings

Gold Medal Winner, Economics, 2017 Axiom Business Books Awards, for *Matchmakers: The New Economics of Multisided Platforms* (with R. Schmalensee)

Winner of the Business, Management & Accounting category in the 2006 Professional/Scholarly Publishing Annual Awards presented by the Association of American Publishers, Inc. for *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries* (with R. Schmalensee).

Top 2% of economists, IDEAS/RePEC, based on quality-weighted citations (November 2019)

Keynote, 2019 Competition Law and Policy Institute of New Zealand, 2019.

Baxt Lecture, University of Melbourne, October 2018.

Special Keynote, CRESSE 2018 Conference on Advances in the Analysis of Competition Policy and Regulation, Crete, Greece, June 2018.

Keynote, Competition Law Conference, Singapore Academy of Law and Competition Commission of Singapore, August 2014.

Beesley Lecture, London Business School, October 2007.

Appearances in Competition and Regulatory Matters

Trial Testimony (including all matters in last four years)

Seoul High Court Case No. 2017u48 (Claim for cancellation of corrective order imposed by Korea Fair Trade Commission on Qualcomm). Written testimony in support of Qualcomm before the Seoul High Court concerning the KFTC's claims of abuse of dominance. (Written testimony filed July 5, 2019).

In the Matter of 1-800 Contacts, Before the Federal Trade Commission, Office of Administrative Law Judges, Docket No. 9372. Testified in support of the Federal Trade Commission, concerning the competitive effects of agreements between 1-800 Contacts and other online sellers of contact lenses that restricted certain forms of search advertising. (April 2017).

In the Matter of the Application of Securities Industry and Financial Markets Association For Review of Actions Taken by Self-Regulatory Organizations Administrative Proceeding File No. 3-15350. Testified in support of the Securities Industry and Financial Markets Association (SIFMA), concerning whether securities exchanges face significant competitive constraints in setting their fees for depth-of-book data products. (April 2015).

Qihoo 360 v. Tencent. Written testimony in support of Tencent before the Supreme People's Court, People's Republic of China, concerning Qihoo 360's market definition and abuse of dominance claims against Tencent. (Written testimony filed for September 2013 trial). Also testified before the Guangdong High Court. (Written submission, April 2012)

Presidential Emergency Board No. 243, National Mediation Board, Case Nos. A-13569, A-13570, A-13572, A-13573, A-13574, A-13575, and A-13592. Testified in support of the National Railway Labor Conference concerning wages, benefits, and work rules for railroad workers. (October 2012).

Case T-201/04, *Microsoft v. Commission of the European Communities*. Testified in support of Microsoft before the Grand Chamber, Court of the First Instance of the European Union concerning the Commission's determination that Microsoft had abused its dominant position by refusing to license certain information regarding its operating system and by tying a media player to its Windows operating system. (April 2006).

Case T-201/04, *Microsoft v. Commission of the European Communities*. Testified before the President, Court of the First Instance of the European Union in support of Microsoft's application for a suspension of remedies during its appeal of a Commission decision. (October 2004).

Case T-201/04, *Microsoft v. Commission of the European Communities*. Testified before Hearing Officer of the European Commission concerning the Commission's determination that Microsoft had abused its dominant position by refusing to license certain information regarding its operating system and by tying a media player to its Windows operating system. (October 2003).

Deposition Testimony (including all matters in last four years)

J Thompson, et al., v. 1-800 Contacts, Inc., et al., Case No. 2:16-CV-1183-TC. Testified for class plaintiffs, concerning the competitive effects of agreements between 1-800 Contacts and other online sellers of contact lenses that restricted certain forms of search advertising. (February 2020).

In re Qualcomm Antitrust Litigation, Case No. 5:17-md-2773-LHK. Rebuttal testimony on behalf of Qualcomm addressing, from the standpoint of antitrust and intellectual property

economics, whether the methodology and calculations presented by Plaintiffs were relevant or reliable. (December 2018).

Apple, Inc. v. Qualcomm, Incorporated, Case No. 17-cv-0108-GPC-MDD. Testified for Qualcomm concerning the economic impact of modern cellular technologies on the growth of the smartphone ecosystem, its economic relevance to licensing negotiations concerning patents involving modern cellular technologies that are subject to a fair, reasonable, and non-discriminatory (FRAND) commitment under European Telecommunications Standards Institute (ETSI) intellectual property rights (IPR) policies, and to evaluate the impact of modern cellular technologies on Apple's revenues and the profits. (October 2018).

In the Matter of 1-800 Contacts, Before the Federal Trade Commission, Office of Administrative Law Judges, Docket No. 9372. Testified for the Federal Trade Commission, concerning the competitive effects of agreements between 1-800 Contacts and other online sellers of contact lenses that restricted certain forms of search advertising. (March 2017).

MarchBanks Truck Service, Inc., et al. v. Comdata Network, Inc., et al., Case No. 07-1078-JKG. Testified for defendant concerning allegations of anticompetitive behavior with respect to Comdata's agreements with certain truck stop chains. (August 2013).

Meredith Corporation et al. v. SESAC, Case No. 09 Civ. 9177 (PAE). Testified for defendant concerning allegations of anticompetitive behavior with respect to the blanket licensing of local television music performance rights. (May 2013).

Other Significant Antitrust Matters

T-Mobile/Sprint Transaction, WT Docket 18-197, Federal Communications Commission, submitted declaration to the FCC concerning the dynamic effects of the proposed merger on cellular data prices and capacity, the competitive investment of other carriers, and the likely value of 5G capacity.

Comcast/Time Warner Cable Transaction, MB Docket No. 14-57, Federal Communications Commission, Economists Roundtable, January 2015, as well as several presentations to FCC senior staff and officials.

U.S. v. Visa et al. concerning alleged exclusionary rules and duality and *U.S. v. Visa et al.* concerning alleged tying of credit and debit cards. On behalf of Visa, lead consulting economics team and worked with testifying experts.

U.S. v. Microsoft concerning alleged monopolization. On behalf of Microsoft, lead consulting economics team, including recruiting and working with testifying experts, for the 1998-1999 original trial and the 2002 trial concerning remedies.

U.S. v. AT&T concerning alleged monopolization. On behalf of the U.S. Department of Justice, lead consulting economics team, and worked with testifying expert, on rebuttal economics testimony.

Amicus Briefs

Brief of Amici Curiae of David S. Evans and Richard Schmalensee in Support of Respondents, *State of Ohio, et al., v. American Express Company, et al.* U.S. Supreme Court, 2018.

Brief of Amici Curiae of David S. Evans and Richard Schmalensee in Support of Appellants-Cross Appellees, *US Airways v. Sabre Holdings Corp.*, 2nd Circuit, 2017.

Brief of Amici Curiae Economists in Support of Petitioners, *Bell Atlantic v. Twombly*, U.S. Supreme Court, 2007 (Principal Author and Signatory).

Brief of Amici Curiae Economists in Support of Petitioners, *Leegin Creative Leather Products, Inc. v. PSKS, Inc.*, U.S. Supreme Court, 2007 (Contributor and Signatory)

Appearances and Submissions Before Competition and Regulatory Authorities

Australian Competition and Consumer Commission
Competition Commission of Singapore
Directorate General for Competition, European Commission
Federal Cartel Office, Germany
Korean Fair Trade Commission
Ministry of Commerce, People's Republic of China
National Development and Reform Commission, People's Republic of China
U.K. Competition and Market Authority
U.S. Federal Reserve Board
U.S. Department of Justice
U.S. Federal Communications Commission
U.S. Federal Trade Commission
U.S. Securities and Exchange Commission

Publications

Books

Antitrust Analysis of Platform Markets: Why the Supreme Court Got It Right in *American Express* (Boston, MA: Competition Policy International, 2019), with R. Schmalensee.

Matchmakers: The New Economics of Multisided Platforms (Cambridge, MA: Harvard Business School Press, 2016), with R. Schmalensee. Published or pending translations in Azerbaijan, Chinese, French, Japanese, Korean, Spanish, Vietnamese. Gold Medal Winner, Economics, 2017 Axiom Business Book Awards.

Platform Economics: Essays on Multi-Sided Businesses, (Boston, Competition Policy

International, 2011), with R. Schmalensee, M. Noel, H. Chang, and D. Garcia-Swartz. (Published in Chinese in 2016 by Economic Science Press.)

Interchange Fees: The Economics and Regulation of What Merchants Pay for Cards, (Boston, Competition Policy International, 2011), with R. Schmalensee, R. Litan, D. Garcia-Swartz, H. Chang, M. Weichert, A. Mateus.

Trustbusters: Competition Authorities Speak Out (Boston: Competition Policy International, 2009), co-editor with F. Jenny.

Catalyst Code: The Strategies of the World's Most Dynamic Companies (Massachusetts: Harvard Business School Press, 2007), with R. Schmalensee. Translated into Chinese, Korean, Polish, and Russian.

Invisible Engines: How Software Platforms Drive Innovation and Transform Industries, (Massachusetts: MIT Press, 2006), with A. Hagiu and R. Schmalensee. Translated into Chinese and Korean. Winner of the Business, Management & Accounting category in the 2006 Professional/Scholarly Publishing Annual Awards presented by the Association of American Publishers, Inc.

Paying with Plastic: The Digital Revolution in Buying and Borrowing (Massachusetts: MIT Press, first edition 1999, second edition 2005), with R. Schmalensee. Translated into Chinese.

Microsoft, Antitrust and the New Economy: Selected Essays (New York: Kluwer Academic Publishers, 2002), editor.

The Economics of Small Businesses: Their Role and Regulation in the U.S. Economy (New York: Holmes and Meier, 1986), with W. Brock.

Breaking Up Bell: Essays on Industrial Organization and Regulation (New York: Elsevier, 1983), editor and co-author of eight of ten chapters.

Articles, Book Chapters, and Working Papers

(Note: links to most of my publications since 2001 appear on my SSRN Home page and links to most of my publications before 2001 appear on my IDEAS Home page.)

“The Economics of Attention Markets,” Working Paper, 2019.

“What Caused the Smartphone Revolution?,” (with H. Chang and S. Joyce) Working Paper, 2019.

“Deterring Bad Behavior on Digital Platforms,” Working Paper, 2019.

“Basic Principles for the Design of Antitrust Analysis for Multisided Platforms,” *Journal of Antitrust Enforcement*, Vol. 7, Iss. 3 (2019).

“Two-Sided Red Herrings,” (with R. Schmalensee), *Antitrust Chronicle*, October 2018.

“The Role Of Market Definition in Assessing Anticompetitive Harm in *Ohio v. American Express*,” (with R. Schmalensee) *Antitrust Chronicle*, June 2019.

“Attention Platforms, the Value of Content, and Public Policy,” *Review of Industrial Organization* Vol. 54 (June 2019).

“What *Times-Picayune* Tells Us About the Antitrust Analysis of Attention Platforms,” *Competition Policy International Antitrust Chronicle*, April 2019

“Ignoring Two-Sided Business Reality Can Also Hurt Plaintiffs,” (with R. Schmalensee), *Antitrust Chronicle*, April 2018.

“Applying the Rule of Reason to Two-Sided Platform Businesses,” *University of Miami Business Law Review* (with R. Schmalensee), Vol. 26, Iss. 2 (2018).

“Multi-Sided Platforms,” *New Palgrave Dictionary of Economics Online*, 2017 (with R. Schmalensee) (forthcoming).

“Economic Findings Concerning the State of Competition for Wired Broadband Provision to U.S. Households and Edge Providers,” Working Paper, 2017.

“Network Effects: March to the Evidence, Not to the Slogans,” *Antitrust Chronicle*, September 2017 (with R. Schmalensee).

“Why the Dynamics of Competition for Online Platforms Leads to Sleepless Nights, But Not Sleepy Monopolies,” in N. Charbit, ed., *Douglas H. Ginsburg Liber Amicorum: An Antitrust Professor on the Bench*, 2017.

“The Emerging High-Court Jurisprudence on the Antitrust Analysis of Multisided Platforms,” *Antitrust Chronicle*, February 2017. Also in D. Gerard, E. Morgan de Ribery and Bernd Meyring, *Dynamic Markets, Dynamic Competition and Dynamic Enforcement* (Brussels: Bruylant, 2018)

“The Businesses That Platforms Are Actually Disrupting,” *Harvard Business Review*, September 21, 2016 (with R. Schmalensee).

“Mobile Advertising: Economics, Evolution, and Policy,” *Antitrust Chronicle*, June 2016.

“A Deep Look Inside Apple Pay’s Matchmaker Economics,” *Harvard Business Review*, June 17, 2016 (with R. Schmalensee).

“The Best Retailers Combine Bricks and Clicks,” *Harvard Business Review*, May 30, 2016 (with R. Schmalensee).

“What Platforms Do Differently than Traditional Businesses,” *Harvard Business Review*, May 11, 2016 (with R. Schmalensee).

“Why Winner-Takes-All Thinking Doesn’t Apply to the Platform Economy,” *Harvard Business Review*, May 4, 2016 (with R. Schmalensee).

“Some of the Most Successful Platforms Are Ones You’ve Never Heard Of,” *Harvard Business Review*, March 28, 2016 (with R. Schmalensee).

“How We Learned (Almost) Everything That’s Wrong with U.S. Census Data,” *Harvard Business Review*, March 11, 2016 (with R. Schmalensee).

“Multisided Platforms, Dynamic Competition and the Assessment of Market Power for Internet-based Firms,” *Competition Policy International*, Spring 2016.

“The Move to Smart Mobile and Its Implications for Antitrust Analysis of Online Market,” *UC Davis Business Law Journal*, 2016 (with Hemant Bhargava and Deepa Mani).

“An Empirical Examination of Why Mobile Money Schemes Ignite in Some Developing Countries but Flounder in Most,” *Review of Network Economics*, 2015.

“The Impact of the U.S. Debit Card Interchange Fee Caps on Consumer Welfare: An Event Study Analysis,” (with H. Chang and S. Joyce), *Journal of Competition Law and Economics*, 2015.

“The Antitrust Analysis of Multi-Sided Platform Businesses,” (with R. Schmalensee), in *Oxford Handbook on International Antitrust Economics*, R. Blair and D. Sokol, eds., Oxford: Oxford University Press, 2015.

“Assessing Unfair Pricing Under China’s Anti-Monopoly Law for Innovation-Intensive Industries,” University of Chicago Coase-Sandor Institute for Law & Economics Research Paper No. 678. *Competition Policy International*, Spring 2014. Chinese version published in the NDRC Price Journal (with V. Zhang and X. Zhang).

“Economic Aspects of Bitcoin and Other Decentralized Public-Ledger Currency Platforms,” University of Chicago Coase-Sandor Institute for Law and Economics Research Paper No. 685, May 2014.

“The Antitrust Analysis of Rules and Standards for Software Platforms,” *Competition Policy International*, Autumn 2014.

“Market Definition Analysis in Latin America with Applications to Internet-Based Industries,” (with E. Mariscal), Working Paper (University of Chicago Law School and Centro de Investigacion y Docencia Economica), 2013.

“Paying with Cash: A Multi-Country Analysis of the Past and Future Use of Cash for Payments by Consumers,” (with K. Webster, G. Colgan, and S. Murray), Working Paper (University of Chicago Law School and Market Platform Dynamics), 2013.

“Payments Innovation and the Use of Cash,” (with K. Webster, G. Colgan, and S. Murray), Working Paper (University of Chicago Law School and Market Platform Dynamics), 2013.

“The Consensus Among Economists on Multisided Platforms and Its Implications for Excluding Evidence that Ignores It,” *Antitrust Chronicle*, 2013, 6(1).

“Analyzing Competition among Internet Players: Qihoo 360 v. Tencent,” (with V. Y. Zhang and H. Chang), *Antitrust Chronicle*, 2013, 5(1).

“Attention Rivalry among Online Platforms,” *Electronics Intellectual Property, MIIT China*, 2013, 9, 30-41(in Chinese).

“Attention Rivalry among Online Platforms and Its Implications for Antitrust Analysis,” *Journal of Competition Law and Economics*, 2013, 9(2), 313-357.

“Economics of Vertical Restraints for Multi-Sided Platforms,” *Competition Policy International*, 2013, 9(1).

“The Role of Keyword Advertising in Competition among Rival Brands,” (with Elisa Mariscal). *Antitrust Chronicle*, 2012, 12(1).

“Will the Wheatley Recommendations Fix LIBOR?” (with R.M. Abrantes-Metz). *Antitrust Chronicle*, 2012, 11(2).

“Governing Bad Behavior by Users of Multi-Sided Platforms,” *Berkeley Technology Law Journal*, 2012, 27(2).

“Replacing the LIBOR with a Transparent and Reliable Index of Interbank Borrowing: Comments on the Wheatley Review of LIBOR Initial Discussion Paper,” (with R.M. Abrantes-Metz), University of Chicago Institute for Law and Economics Olin Research Paper No. 620, 2012.

“Two-Sided Markets,” in *Market Definition in Antitrust: Theory and Case Studies*, 2012.

“Why Come Platform Businesses Face Many Frivolous Antitrust Complaints and What to Do About It,” *Competition Policy International*, 2012, 8(2).

“Lightening Up on Market Definition,” in *Research Handbook on the Economics of Antitrust Law*, E. Elhauge, ed., New York: Edward Elgar, 2012.

“Payments Innovation and Interchange Fees Regulation: How Inverting the Merchant-Pays Business Model Would Affect the Extent and Direction of Innovation,” Working Paper (University of Chicago Law School), 2011.

“How Changes in Payment Card Interchange Fees Affect Consumers Fees and Merchant Prices: An Economic Analysis with Applications to the European Union,” with A.M. Mateus, Working Paper (University of Chicago Law School and New University of Lisbon), 2011.

“Economic Analysis of Claims in Support of the ‘Durbin Amendment’ to Regulation Debit Card Interchange Fees,” with H.H. Chang and M.M. Weichert, Working Paper (University of Chicago Law School, Global Economics Group, and Market Platform Dynamics), 2011.

“The Antitrust Economics of Free.” *Competition Policy International*, 2011, 7(1).

“Conversations with Jon Leibowitz and Joaquin Almunia,” (with Jon Leibowitz and Joaquin Almunia). *Competition Policy International*, 2011, 7(1).

“The Economic Principles for Establishing Reasonable Regulation of Debit-Card Interchange Fees that Could Improve Consumer Welfare,” (with R.E. Litan and R. Schmalensee), Working Paper (University of Chicago Law School, AEI-Brookings Joint Center for Regulatory Studies, and MIT), 2011.

“The Regulation of Interchange Fees by the U.S. Federal Reserve Board: A Primer on Economic Principles, II,” *Antitrust Chronicle*, 2011, 12(2).

“AT&T/T-Mobile: Does Efficiency Really Count?” (with H. Chang & R. Schmalensee) *Antitrust Chronicle*, 2011, 10(2).

“Net Neutrality Regulation and the Evolution of the Internet Economy,” *Antitrust Chronicle*, 2011, 8(2).

“A Presentation on Assessment of Market Power and Dominance,” *Antitrust Chronicle*, 2011, 6(1).

“Economic Analysis of the Effects of the Federal Reserve Board’s Proposed Debit Card Interchange Fee Regulations on Consumers and Small Businesses,” (with R.E. Litan and R. Schmalensee), Working Paper (University of Chicago Law School, AEI-Brookings Joint Center for Regulatory Studies, and MIT), 2011.

“Essays on the Economics of Two-Sided Markets: Economics, Antitrust and Strategy,” Working Paper (University of Chicago Law School), 2010.

“Failure to Launch: Critical Mass in Platform Businesses,” (with Richard Schmalensee). *Review of Network Economics*, 2010, 9(4).

“The Effect of the Consumer Financial Protection Act of 2009 on Consumer Credit,” *Loyola Consumer Law Review*, 2010, 22(3).

“The Web Economy, Two-Sided Markets, and Competition Policy,” Working Paper (University of Chicago Law School), 2010.

“Why Now is Not the Time to Revamp Consumer Financial Protection,” Working Paper (University of Chicago Law School), 2010.

“The New Consensus on Class Certification: What it means for the Use of Economic and Statistical Evidence in Meeting the Requirements of Rule 23,” *Antitrust Chronicle*, 2010, 1(1).

“A Response to Professor Levitin on the Effect of the Consumer Financial Protection Agency Act of 2009 on Consumer Credit,” (with J.D. Weight), George Mason Law and Economics Research Paper No. 09-56, 2009.

“The Middle Way on Applying Antitrust to Information Technology,” *Antitrust Chronicle*, 2009, 11(2).

“How the Consumer Financial Protection Agency Act of 2009 Would Change the Law and Regulation of Consumer Financial Products,” (with J. Wright), *Bloomberg Law Reports: Risk and Compliance*, 2009, 2(10).

“The Online Advertising Industry: Economics, Evolution, and Privacy,” *Journal of Economic Perspectives*, 2009, 23(3), 37-60.

“Why Different Jurisdictions Do Not (and Should Not) Adopt the Same Antitrust Rules,” *Chicago Journal of International Law*, 2009, 10, 161.

“Innovation in Payments,” (with R. Schmalensee), in *Moving Money: The Future of Consumer Payments*, M. Baily and R. Litan, eds., DC: Brookings Institution Press, 2009.

“How Catalysts Ignite: The Economics of Platform-Based Start-Ups,” in *Platforms, Markets and Innovation*, A. Gawer, ed., Cheltenham, UK and Northampton, MA, US: Edward Elgar, 2009.

“The Microsoft Judgment and its Implications for Competition Policy towards Dominant Firms in Europe,” (with C. Ahlborn), *Antitrust Law Journal*, 2009, 75(3), 887.

“Trustbusting Goes Global,” in *Trustbusters: Competition Policy Authorities Speak Out*, D. Evans and F. Jenny, eds., Boston: Competition Policy International, 2009.

“What You Need to Know About Twombly: The Use and Misuse of Economic and Statistical Evidence in Pleadings,” *Antitrust Chronicle*, 2009, 7(2).

The Economics of Market Coordination for the Check-Clearing System in the Late 19th Century United States (October 1, 2007). *Explorations in Economic History*, Vol. 45, pp. 445-461, 2008. (with H. Chang, M. Danilevsky, and D. Garcia-Swartz).

“Markets with Two-Sided Platforms,” (with R. Schmalensee), in *Issues in Competition Law and Policy*, Vol. 1, American Bar Association, August 2008.

“Antitrust Issues Raised by the Emerging Global Internet Economy,” *Northwestern University Law Review*, 2008, 102(4), 285-306.

“Competition and Regulatory Policy for Multi-sided Platforms with Applications to the Web Economy,” *Concurrences*, 2008, 2, 57-62.

“The Lawful Acquisition and Exercise of Monopoly Power and its Implications for the Objectives of Antitrust,” (with K. Hylton), *Competition Policy International*, 2008, 4(2).

“The Analysis of Mergers that Involve Multisided Platform Businesses,” (with M. Noel), *Journal of Competition Law and Economics*, 2008, 4(3).

“The Economics of the Online Advertising Industry,” *Review of Network Economics*, 2008, 7(3).

“The Economics of Market Coordination for the Pre-Fed Check-Clearing System: A Peek into the Bloomington (IL) Node,” (with H. Chang, M. Danilevsky, and D. Garcia-Swartz), *Explorations in Economic History*, 2008, 45(4).

“The Role of Cost in Determining When Firms Offer Bundles and Ties,” (with M. Salinger), *Journal of Industrial Economics*, 2008, 56(1).

“Economics and the Design of Competition Law,” in *Issues in Competition Law and Policy*, W Collins, ed., Vol. 1, American Bar Association, August 2008.

“Has the Pendulum Swung Too Far?” (with H. Chang), *Regulation*, Winter 2007-2008. 30(4).

“Do Mobile Operators Have a Dominant Position in a Market for the Wholesale Termination of Calls from Fixed to Mobile?” *The Economics of Mobile Prices, Vodafone Policy Paper Series*, 2007, 7(4).

“Designing the Right Product Offerings,” (with K. Webster), *Sloan Management Review*, Fall 2007.

“Pick Your Pricing,” (with R. Schmalensee), *Chief Executive Magazine, Incorporated*, No. 227, Summer 2007.

“The Industrial Organization of Markets with Two-Sided Platforms,” (with R. Schmalensee), *Competition Policy International*, 2007, 3(1).

“Defining Markets That Involve Multi-Sided Platform Businesses: An Empirical Framework with an Application to Google’s Purchase of DoubleClick,” (with M. Noel), Reg-Markets Center Working Paper No. 07-18, 2007.

“A Pragmatic Approach to Identifying and Analyzing Legitimate Tying Cases,” (with A. Padilla and M. Salinger), in *European Competition Law Annual 2003: What is an Abuse of a Dominant Position?* Oxford: Hart Publishing, 2006.

“The Optimal Prosecution of Corporate Fraud: An Error Cost Analysis,” (with H. Chang), Working Paper (LECG and eSapience), 2006.

“A Somber Anniversary: Terrorism Insurance Five Years after 9/11,” (with D. Garcia-Schwartz and A. Layne-Farrar), Barbon Discussion Paper No. 06-02, 2006.

“Untying the Knot: The Case for Overruling Jefferson Parish,” Working Paper (LECG), 2006.

“An Empirical Analysis of Bundling and Tying: Over-the-Counter Pain Relief and Cold Medicines,” (with M. Salinger), in *Recent Developments in Antitrust: Theory and Evidence*, J. Choi, ed., Massachusetts: The MIT Press, 2006.

“The Economics of Software Platforms: An Application of Theory of Two-Sided Markets,” (with A. Hagiu and R. Schmalensee), *Industrial Organization and the Digital Economy*, G. Illing and M. Peitz, eds., (Massachusetts: The MIT Press, July 2006).

“Tying: The Poster Child for Antitrust Modernization” in *Antitrust Policy and Vertical Restraints*, R. Hahn, ed., DC: Brookings Institution Press, 2006.

“The Architecture of Product Offerings,” (with Karen Webster), Working Paper (University of Chicago Law School and Market Platform Dynamics), 2006.

“Testimony on Tying for the DOJ/FTC Hearings on Single-Firm Conduct,” *Antitrust Chronicle*, 2006, 11(1).

“The Law and Economics of Tying,” (with C. Ahlborn, J. Padilla, and M. Salinger), *Antitrust Chronicle*, 2006, 11(1).

“Defining Antitrust Markets When Firms Operate Two-Sided Platforms,” (with M. Noel), *Columbia Business Law Review*, 2005, 3.

“U.S. v. Microsoft: Did Consumers Win?” (with R. Schmalensee and A. Nichols), *Journal of Competition Law and Economics*, 2005, 1(3), 497-539.

“The Effect of Regulatory Intervention in Two-Sided Markets: An Assessment of Interchange-Fee Capping in Australia,” (with H. Chang and D. Garcia-Swartz), *Review of Network Economics*, 2005, 4(4).

“Designing Antitrust Rules for Assessing Unilateral Practices: A Neo-Chicago Approach,” (with A. Padilla), *University of Chicago Law Review*, 2005, 72(1), 73-98.

“Why Do Firms Bundle and Tie? Evidence from Competitive Markets and Implications for Tying Law,” (with M. Salinger), *Yale Journal on Regulation*, 2005, 22(1), 37-89.

“The Logic and Limits of the Exceptional Circumstances Test,” (with C. Ahlborn and A. Padilla), *Magill and IMS Health, Fordham Journal of International Law*, 2005, 28(4), 1109-1156.

“Analyzing Market Definition and Power in Multi-sided Platforms Markets,” (with M. Noel), Working Paper (University of Chicago Law School and University of California, San Diego), 2005.

“The Economics of Interchange Fees and Their Regulation: An Overview,” MIT Sloan Working Paper No. 4548-05, May 2005.

“How Economists Can Help Courts Design Competition Rules – An EU and US Perspective,” *World Competition: Law and Economics Review*, 2005, 28(1).

“2004: The Beginning of Change,” *American Banker-Bond Buyer*, 2005, 17(12).

“The Economics of Interchange Fees and Their Regulation: An Overview,” (with R. Schmalensee), MIT Sloan Working Paper No. 4548-05, 2005.

“Tying Under Article 82 EC and the Microsoft Decision: A Comment on Dolmans and Graf,” (with A. Padilla), *World Competition: Law and Economics Review*, 2005, 28(1), 93-99.

“The Changing Role of Economics in Competition Policy Decisions by the European Commission during the Monti Years,” (with C. Grave), *Competition Policy International*, 2005, 1(1).

“Excessive Prices: Using Economics to Define Administrable Legal Rules,” (with A. Padilla), *Journal of Competition Law & Economics*, 2005, 1(1), 97-122.

“Curing Sinus Headaches and Tying Law: An Empirical Analysis of Bundling Decongestants and Pain Relievers,” (with M. Salinger), CESifo Working Paper Series No. 1519, 2005.

“The Retailer Class Action Antitrust Case Against the Card Associations,” (with H. Chang and R. Schmalensee), *The Payment Card Economics Review*, Winter 2004, Vol. 2.

“More Than Money: The Development of a Competitive Electronic Payments Industry in the United States,” *The Payment Economics Review*, Winter 2004, Vol. 2.

“The Growth and Diffusion of Credit Cards in Society,” *The Payment Economics Review*, Winter 2004, Vol. 2.

“The Role of Credit Cards in Providing Financing for Small Businesses,” (with D. Blanchflower), *Payment Card Economics Review*, Winter 2004, Vol. 2.

“A Little Knowledge Can Be a Dangerous Thing: Price Controls in the Yellow Pages Industry,” (with A. Oldale and E. Wang), *European Competition Law Review*, October 2004, 25(10), 607-610.

“A Survey of the Economic Role of Software Platforms in Computer-Based Industries,” (with R. Schmalensee and A. Hagiu), CESifo Working Paper Series No. 1314, 2004.

“Software Patents and Open Source: The Battle Over Intellectual Property Rights,” (with A. Layne-Farrar) *Virginia Journal of Law & Technology*, Summer 2004, 9(10).

“The Antitrust Economics of Tying: A Farewell to Per Se Illegality,” (with C. Ahlborn and A. Padilla), *Antitrust Bulletin*, 2004, 49(1/2), 287-341.

“Competition, Cooperation and Upheaval: So-called co-opetition in payment cards is a work in progress-one affected by rapidly changing business relationships and punctuated by court decisions. How will this dance play out?” *American Banker-Bond Buyer*, 2004, 17(1).

“What’s Yours Is Mine,” *The Wall Street Journal*, February 2004, at A7.

“Will Retailers Stampeded to Drop Signature Debit?” *American Banker*, January 2004.

“Managing the Maze of Multisided Markets,” *Strategy+Business*, Fall 2003.

“Regulators set bar high for foreign insurers,” (with M. Ross), *South China Morning Post*, November 2003.

“Some Empirical Aspects of Multi-Sided Platform Industries,” *Review of Network Economics*, 2003, 2(3).

“Demand-Side Efficiencies in Merger Control,” (with A. Padilla), *World Competition Law and Economics Review*, 2003, 26(2).

“Has the Consumer Harm Standard Lost Its Teeth?” (with H. Chang and R. Schmalensee), in *High-Stakes Antitrust - The Last Hurrah?* R. Hahn, ed., Washington, DC: Brookings Institution Press, 2003.

“The Antitrust Economics of Multi-Sided Platform Markets,” *Yale Journal on Regulation*, 2003, 20(2).

“Everything You Wanted to Know about Two-Sided Markets,” (with P. Passell), *The Milken Institute Review*, Second Quarter 2003.

“Government Preferences for Promoting Open-Source Software: A Solution in Search of a Problem,” (with B. Reddy), *Michigan Telecommunications and Technology Law Review*, 2003, 9(2).

“The Failure of E-Commerce Business: A Surprise or Not?” (with D. Garcia-Swartz and B. Martin-Keating), *European Business Organization Law Review*, 2002, 3.

“Tying in Platform Software: Reasons for a *Rule-of-Reason* Standard in European Competition Law,” (with A. Padilla and M. Polo), *World Competition Law and Economics Review*, 2002, 25(4).

“Who Owns Ideas? The War Over Global Intellectual Property,” *Foreign Affairs*, November/December 2002.

“The New Trustbusters—Brussels and Washington May Part Ways,” *Foreign Affairs*, January/February 2002, 81(1).

“Class Certification, the Merits, and Expert Evidence,” *George Mason Law Review*, 2002, 11(1).

“Class Certification and the Substantive Merits,” (with R. Bone), *Duke Law Journal*, 2002, 51(4).

“Some Economic Aspects of Antitrust Analysis in Dynamically Competitive Industries,” (with R. Schmalensee), in *Innovation Policy and the Economy*, Vol. 2, A. Jaffe, J. Lerner and S. Stern, eds., Cambridge, MA: MIT Press, 2002.

“The Rise and Fall of Leaders in Personal Computer Software,” (with A. Nichols and B. Reddy), in *Microsoft, Antitrust and the New Economy: Selected Essays*, D. Evans, ed., Norwell, MA: Kluwer Academic Publishers, 2002.

“Why Does Microsoft Charge So Little for Windows,” (with A. Nichols and B. Reddy), in *Microsoft, Antitrust and the New Economy: Selected Essays*, D. Evans, ed., Norwell, MA: Kluwer Academic Publishers, 2002.

“Dodging the Consumer Harm Inquiry: A Brief Survey of Recent Government Antitrust Cases,” *St. John’s Law Review*, 2001, 75(3).

“Is Free Software the Wave of the Future?” *The Milken Institute Review*, Fourth Quarter 2001.

“Industry Regulation Through Antitrust: The Clinton Legacy and the Bush Future,” *Regulation*, Fall 2001.

“Clinton’s Brave New Business World,” *Regulation*, Fall 2001, 24(3).

“The Problem of Interchange Fee Analysis: Case Without a Cause?” (with C. Ahlborn and H. Chang), *European Competition Law Review*, 2001, 22(8).

“An Analysis of the Government’s Economic Case in *U.S. v. Microsoft*,” (with A. Nichols and R. Schmalensee), *Antitrust Bulletin*, Summer 2001.

“A Monopolist Would Still Charge More for Windows: A Comment on Werden,” and “A Monopolist Would Still Charge More for Windows: A Comment on Werden’s Reply,” (with B. Reddy, A. Nichols and R. Schmalensee), *Review of Industrial Organization*, 2001, 18(3).

“Competition Policy in the New Economy: Is European Competition Law Up to the Challenge?” (with C. Ahlborn and A. Padilla), *European Competition Law Review*, May 2001, No. 5.

“An Analysis of the Government’s Economic Case in *U.S. v. Microsoft*,” in *Antitrust Bulletin*, with A. Nichols and R. Schmalensee, Summer 2001. Reprinted in *Microsoft, Antitrust and the New Economy: Selected Essays*, D. Evans, ed., Norwell, MA: Kluwer Academic Publishers, 2002.

“*U.S. v. Microsoft*, Remedy or Malady?” (with K. Elzinga and A. Nichols), *George Mason Law Review*, 2001, 9(3). Reprinted in *Microsoft, Antitrust and the New Economy: Selected Essays*, D. Evans, ed., Norwell, MA: Kluwer Academic Publishers, 2002.

“Antitrust and the New Economy,” *Computer Industry Committee Newsletter*, Spring 2001.

“The Competitive Effects of the Collective Setting of Interchange Fees by Payment Card Systems,” (with H. Chang), *The Antitrust Bulletin*, Fall 2000.

“Be Nice To Your Rivals: How the Government Is Selling an Antitrust Case without Consumer Harm in *U.S. v. Microsoft*,” (with R. Schmalensee), in *Did Microsoft Harm Consumers? Two*

Opposing Views, AEI-Brookings Joint Center for Regulatory Studies: Washington DC, May 2000.

“Consumers Lose if Leading Firms are Smashed for Competing,” (with R. Schmalensee), in *Did Microsoft Harm Consumers? Two Opposing Views*, AEI-Brookings Joint Center for Regulatory Studies: Washington DC, May 2000.

“Economics for the Third Industrial Revolution,” (with M. Leder), *Viewpoint, The Marsh & McLennan Companies Journal*, 1999, No. 1.

“All the Facts That Fit: Square Pegs and Round Holes in *U.S. v. Microsoft*,” *Regulation*, November 1999, 22(4).

“Joint Ventures: *MountainWest*,” (with R. Schmalensee), in *The Antitrust Revolution*, 3rd edition, J. Kwoka and L. White, eds., New York: Oxford University Press, 1998.

“Some Economic Principles for Guiding Antitrust Policy Towards Joint Ventures,” (with H. Chang and R. Schmalensee), *Columbia Business Law Review*, 1998, No. 2.

“A Guide to the Antitrust Economics of Networks,” (with R. Schmalensee), *Antitrust*, Spring 1996.

“Some Economic Aspects of Standards in Network Industries and Their Relevance to Antitrust and Intellectual Property Law,” (with B. Reddy), *Intellectual Property Antitrust, Practicing Law Institute*, July 1996, Vol. 1.

“Defining Relevant Antitrust Markets with Special Application to Intellectual Property,” *Intellectual Property Antitrust, Practicing Law Institute*, July 1996, Vol. 1.

“A Tailored Approach to Diversity Planning,” (with M. Oh), *HR Magazine*, 1996, 41(6).

“Market Definition in Antitrust and Patent-Infringement Litigation,” *Practicing Law Institute*, July 1995, Vol. 1.

“Economic Aspects of Payment Card Systems and Antitrust Policy Toward Joint Ventures,” (with R. Schmalensee), *Antitrust Law Journal*, Spring 1995.

“Retrospective Bias in the Displaced Worker Surveys,” (with L. Leighton), *Journal of Human Resources*, Winter 1995.

“Industry Dynamics and Small Firms,” in *Births and Start-up of Small Firms*, F. Cicogna, ed., Amsterdam: Kluwer Publishing Co., 1995.

“Common Statistical Fallacies in Pattern-and-Practice Employment Discrimination Cases,” *American Employment Law Council*, October 1995.

“Entrepreneurship and Small Business Growth: A Case Study,” (with Z. Acs), in *Advances in the Study of Entrepreneurship*, G. Libecap, ed., Greenwich, Ct.: JAI Press, 1993.

“An Economic Approach to the Mitigation of Damages in Age Discrimination Cases,” *Advanced Employment Law and Litigation: ALI-ABA Course of Study Materials*, Vol. 2, Washington, DC: American Law Institute-American Bar Association Committee on Continuing Professional Education, 1992.

“Small Business Formation and Success by Unemployed Workers,” (with L. Leighton), *Small Business Economics*, 1990.

“Trade Associations and the Exchange of Price and Nonprice Information,” in *Annual Proceedings of the Fordham Corporate Law Institute: 1992 and EEC/U.S. Competition and Trade Law*, B. Hawk, ed., 1990.

“An Estimated Model of Entrepreneurial Choice Under Liquidity Constraints,” (with B. Jovanovic), *Journal of Political Economy*, 1989, 97(4), 808-827. Reprinted in *Small Firms and Economic Growth*, International Library of Critical Writings in Economics, Z. Acs, ed., Cheltenham, UK: Edward Elgar Publishing, Ltd., 1995.

“Some Empirical Aspects of Entrepreneurship,” (with L. Leighton), *American Economic Review*, 1989, 79(3), 519-535. Reprinted in *Entrepreneurship*, International Library of Critical Writings in Economics, M. Casson, ed., Hants, England: Edward Elgar Publishing Co., 1990.

“Why Do Smaller Firms Pay Less?” (with L. Leighton), *Journal of Human Resources*, 1989, 24(4), 299-318. Reprinted in *Small Firms and Economic Growth*, Z. Acs, ed., Cheltenham, UK: Edward Elgar Publishing, Ltd., 1995.

“Small Business Economics,” (with W. Brock), *Small Business Economics*, 1989, 1(1), 7-20. Reprinted in *Small Firms and Economic Growth*, Z. Acs, ed., Cheltenham, UK: Edward Elgar Publishing, Ltd., 1995.

“Tests of Alternative Theories of Firm Growth,” *Journal of Political Economy*, 1987, 95(4), 657-674. Reprinted in *Small Firms and Economic Growth*, Z. Acs, ed., Cheltenham, UK: Edward Elgar Publishing, Ltd., 1995.

“The Determinants of Changes in U.S. Self-Employment, 1968-1987,” *Small Business Economics*, 1989, 1(2), 111-119.

“The Relationship Between Firm Growth, Size and Age: Estimates for 100 Manufacturing Industries,” *Journal of Industrial Economics*, June 1987. Reprinted in *The Empirical Renaissance in Industrial Economics*, R. Schmalensee, ed., London: Basil Blackwell, 1988.

“Natural Monopoly and the Bell System: Response to Charnes, Cooper and Sueyoshi,” (with J. Heckman), *Management Science*, 1988, 34(1), 27-38.

“Empirical Analysis of the Size Distribution of Farms: Discussion,” *American Journal of Agricultural Economics*, 1987, 69(2), 484-485.

“The Differential Effect of Regulation Across Plant Size: Comment on Pashigian,” *Journal of Law and Economics*, 1986, 29(1), 187-200.

“A Test for Subadditivity of the Cost Function with an Application to the Bell System,” *American Economic Review*, with J. Heckman, September 1986, 76(4), 856-858.

“The Economics of Regulatory Tiering,” (with W. Brock), *RAND Journal of Economics*, 1985, 16(3), 398-409. Reprinted in *Small Firms and Economic Growth*, Z. Acs, ed., Cheltenham, UK: Edward Elgar Publishing, Ltd., 1995.

“The Audience Revenue Relationship for Local Broadcast Stations,” (with F. Fisher and J. McGowan), *Bell Journal of Economics*, 1980, 11(2), 694-708.

“Cross Country Prediction of Consumption Patterns,” *Economic Letters*, 1979, 3(1), 85-88.